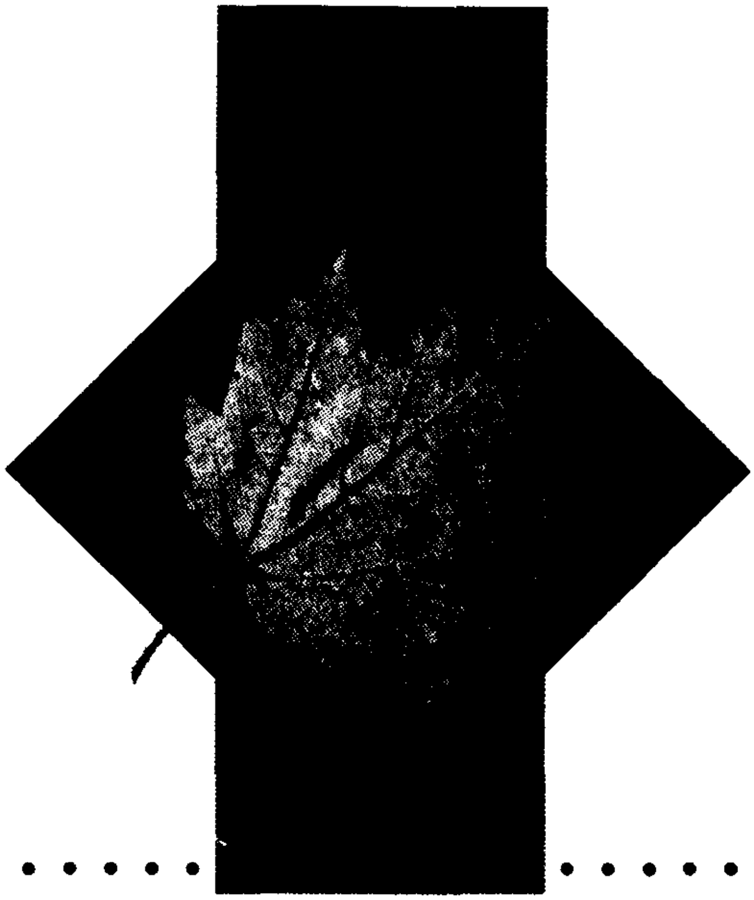


Advanced Flue Gas Desulfurization (AFGD)
Demonstration Project

Cooperative Agreement No. DE-FC22-90PC89660

DOE Test Report #1

Prepared by

Pure Air
7540 Windsor Drive
Allentown, PA 18195

Prepared for

U.S. Department of Energy
Pittsburgh Energy Technology Center
P.O. Box 10940
Pittsburgh, PA 15236

Advanced Flue Gas Desulfurization (AFGD) Demonstration Project

Cooperative Agreement No. DE-FC22-90PC89660

DOE TEST REPORT #1

PREPARED BY

PURE AIR
7540 Windsor Drive
Allentown, PA 18195

PREPARED FOR

U.S. DEPARTMENT OF ENERGY
Pittsburgh Energy Technology Center
P.O. Box 10940
Pittsburgh, PA 15236

Pure Air on the Lake, Limited Partnership

13 October 1993

Mr. Thomas A. Sarkus
U.S. Department of Energy
Pittsburgh Energy Technology Center
P. O. Box 10940
Pittsburgh, PA 15236-0940

Subject: DOE Test Report #1
Cooperative Agreement No. DE-FC22-90PC89660

Dear Mr. Sarkus:

In accordance with Attachment C of the above-mentioned Cooperative Agreement, transmitted within are two copies of the DOE Test Report #1.

If you have any questions/comments regarding this report, please do not hesitate to call me at 215-481-3687.

Sincerely,

Don C Vymazal

Don C. Vymazal
Manager, Contract Administration

DCV:mck/Vymazal\1253
Encl.

Distribution:

Mr. Thomas A. Sarkus (2)
PETC Technical Project Manager
Mail Stop 920-L
U.S. Department of Energy/PETC
P. O. Box 10940
Pittsburgh, PA 15236

Mr. Richard D. Rogus (1)
Contracting Specialist
AD-21, Mail Stop 921-165
U.S. Department of Energy/PETC
P. O. Box 10940
Pittsburgh, PA 15236

Dr. C. Lowell Miller (3)
Associate Deputy Assistant
Secretary for Clean Coal Technology
FE-22, 3E-042, Forrestal
U.S. Department of Energy
Washington, DC 20585

Dr. S. N. Roger Rao (1)
Burns and Roe Technical Group Mgr.
P. O. Box 18288
Pittsburgh, PA 15236

Dr. Lawrence Saroff (1)
HQ DOE Program Manager
FE-221, 3E-042, Forrestal
U.S. Department of Energy
Washington, DC 20585

cc: J. Brown - Bailly
J. Henderson - Bailly
G. B. Manavizadeh
R. C. Reighard
C. L. Yeh

DCV:mck/Vymazal\1234

TABLE OF CONTENTS

ABSTRACT

This report is on the first of 6 tests that will occur during the initial three years of operation of Pure Airs' Advanced Flue Gas Desulfurization unit (AFGD) situated at Northern Indiana Public Service Company's Bailly Generating Station. The three-year program, funded by the Department of Energy, (DOE) will test coals ranging in sulfur content from 2.0 to 4.5%. This report describes the test conducted during August and September of 1992 with a coal having an average sulfur content of 3.2%.

1.0 EXECUTIVE SUMMARY

A series of special tests have been scheduled as part of the cooperative agreement between Pure Air and the DOE (Department of Energy) where coals of varying sulfur levels ranging from 2.0 to 4.5% will be tested, during which important process variables in the AFGD will be examined. This report is the first of the series covering a test conducted during the period of August 10, 1992 to September 29, 1992 using a coal with an average Sulfur content of 3.2%. The test was divided into studies of calcium to sulfur ratio, liquid to gas ratios, and an examination of the Air Rotary Sparger (ARS) efficiency. The results of the testing showed that the AFGD unit exceeded the performance expectations of the original design.

2.0 INTRODUCTION

2.1 PROJECT DESCRIPTION

Pure Air, a general partnership between Air Products and Chemicals, Inc. (Air Products) and Mitsubishi Heavy Industries America, Inc. (MHIA), was established in 1985 to market flue gas desulfurization (FGD) equipment and services in North America. MHIA is a wholly-owned subsidiary of Mitsubishi Heavy Industries, Ltd. which has sold 92 FGD units worldwide, with a total of over 500 years of operating time on all the units combined. The joint venture combines Mitsubishi's Advanced FGD technology with Air Products' plant construction and operations capability to form a company which can either sell the FGD equipment or design, construct, finance, own, operate, and maintain FGD plants. Air Products pioneered the "On-Site" concept over 40 years ago, and currently owns and operates over 165 industrial gas, chemical, cogeneration, and waste-to-energy plants around the world. Many of the same types of economic benefits successfully demonstrated in other industries with own and operate project services provided by an experienced chemical plant operator can be transferred to the FGD market. Pure Air began development efforts in early 1988 for an On-Site Advanced FGD facility serving the Northern Indiana Public Service Company (Northern Indiana). With the cooperation of Northern Indiana, the project was submitted to the United States Department of Energy (DOE) for consideration under the Innovative Clean Coal Technology Program (Solicitation II), and was selected in September 1988 to receive cooperative funding of $63,434,000.

In September 1989, a flue gas processing agreement was signed with Northern Indiana, whereby, an Advanced FGD facility would be constructed at its Bailly Generating Station in Dunes Acres, Porter County, Indiana (on the southern shore of Lake Michigan adjacent to the National Lakeshore). The facility provides flue gas processing services for Bailly Units #7 and #8 which together have a nameplate capacity of approximately 600 megawatts.

The AFGD demonstration at Bailly station will showcase several advanced features, compared to conventional FGD systems in operation throughout the United States. These features are described below.

Single Large Absorber

Ordinarily, an FGD facility contains several SO_2 absorber or "scrubber" modules, with one spare module added to improve system reliability. The AFGD facility at Bailly utilizes a single nominal 600 MWe absorber module. It is the largest capacity absorber module in the United States, scrubbing all the flue gases from the Bailly station's two coal-fired boilers. There are no spare or back-up modules. Instead, a high degree of system reliability will be demonstrated, as the scrubber is capable of removing 95% or more of the SO_2, without the use of performance-enhancing chemical additives.

Single Loop Scrubber with In Situ Oxidation

Another space-saving feature is the utilization of the SO_2 absorber to perform three separate functions: prequencher, absorber, and oxidation of scrubber sludge ($CASO_3$, calcium sulfite) to gypsum ($CaSO_4$, calcium sulfate). Older FGD systems often employ two or three separate vessels to perform these functions. The AFGD system at Bailly produces a gypsum by-product that is suitable for commercial uses such as wallboard or cement. This is in lieu of producing scrubber sludge, which would have to be landfilled as solid waste.

High Velocity Co-Current Absorber

The SO_2 absorber utilizes a high velocity co-current design, in which the scrubbing slurry moves in the same direction as the flue gas flow. Operation at a relatively high flue gas velocity of approximately 20 feet per second allows for a more compact absorber. This feature, combined with the absence of any back-up modules, contributes to improved space requirements for the AFGD system.

Direct Limestone Injection

At Bailly, pulverized limestone is injected directly into the SO_2 absorber. The pulverized limestone is purchased from a limestone supplier, thereby eliminating the need for on-site wet grinding systems.

Air Rotary Sparger

A novel device known as an air rotary sparger (ARS) is being demonstrated within the absorber module. Basically, the ARS combines the functions of mixing and air distribution within the absorber, thereby facilitating the oxidation of scrubber sludge to gypsum. In a conventional FGD system, mixing would be done by agitators while oxidation air distribution would be performed by a separate fixed sparger arrangement. Merging these functions into one equipment item is expected to provide better mixing within the base of the absorber.

Wastewater Evaporation System

Wastewater disposal often poses a difficult problem for scrubber operators, particularly where the oxidation of scrubber sludge to gypsum is employed. The AFGD project at Bailly demonstrates a novel wastewater evaporation system (WES), whereby process wastewater is injected into the flue gas ductwork upstream of the existing electrostatic precipitator (ESP). The hot flue gas evaporates the wastewater, and dissolved solids in the wastewater solidify so that they are collected by the ESP, along with the fly ash. At Bailly, the WES is demonstrated only on one boiler unit (i.e. 345 MWe). If successful, it could lead to zero liquid discharge scrubbers. That is, the scrubbers would produce a usable gypsum by-product and no waste water effluent.

On-Site Own and Operate

In addition to state-of-the art technical features, the AFGD project is showcasing a novel business arrangement. Normally, utility companies must contract with several different firms to design and build a scrubber, and once it is built, the utility must operate the scrubber. By contrast, Pure Air will design, finance, build, own, maintain, and operate the Bailly AFGD facility for Northern Indiana as a contractual service. This "own and operate" approach has been employed successfully by Pure Air's parent, Air Products & Chemicals, in other business lines. Its application to flue gas cleanup is attractive to many utilities for a variety of reasons. For example, it allows the utility company to focus on the business of electricity generation and distribution, while Pure Air utilizes its own expertise to own and operate the scrubber facility.

Construction activities began in March 1990, and were completed in June 1992 -- ahead of schedule and within budget. A three-year demonstration period will then prove the efficacy of AGFD technology with a range of high-sulfur United States coals. A successful demonstration would be followed by a long-term commercial operation period, pursuant to the agreement between Pure Air and Northern Indiana.

2.2 DEMONSTRATION PROGRAM EXECUTION

As part of the three (3) year DOE demonstration period which began June 15, 1992, six (6) special tests will be conducted utilizing up to six (6) different coals with Sulfur contents based on the following table.

Test No.	Coal Sulfur Content Wt%	Duration of Test # of Days
I	<2.5	30
II	2.5 - 3.0	30
III	3.0 - 3.5	30
IV	3.5 - 4.0	30
V	>4.0	15
VI	Optimum	50

The objectives of the demonstration tests are to determine the effect of L/G ratio (LIQUID/GAS), Ca/S (Calcium/Sulfur) ratios and the effect of oxidation air flow to the ARS (Air Rotary Sparger) on the overall system performance including SO_2 removal efficiency, and Gypsum quality.

This report is on the third test of the series of six as shown in the above table. This was due to the fact that the coal being burned by the power station was in the 3.0 - 3.5 wt% sulfur range. This is the baseline coal for the Bailly Generating Station. The test began on August 10 and ended on September 29, 1992. Twenty-seven different conditions were run during the test period to evaluate L/G, Ca/S ratios and oxidation air effect. The use of the baseline coal for the first test afforded a considerable amount of flexibility for the management of the test, since tests could be repeated easily without the concern for a limited supply of coal that had been specially purchased. The Bailly power station is part of the NIPSCO power grid dispatch system and as a result load changes were seen during the 24 hour period. Constant loads were generally achieved between 7 A.M. AND 7 P.M. during the testing day. Seventy-two hours were allowed between load changes to allow the plant to reach a new equilibrium point.

3.0 BAILLY AFGD PROJECT DESCRIPTION

3.1 BACKGROUND

The primary purpose of the Bailly project is to demonstrate that by combining Advanced FGD technology, highly efficient and sophisticated plant operation and maintenance capabilities, and by-product gypsum sales, significant reductions of sulfur dioxide emissions can be achieved at a substantially lower cost than for currently available FGD systems. The Bailly project will use the following advanced features which will have economic effects on future FGD systems:

- Single 600 MW module which will reduce costs for power plants over 200 MW. Use of a single 100% capacity absorber module will demonstrate that spare modules are no longer necessary due to the high reliability of the module design.
- Co-current, single loop absorber with in-situ oxidation producing high quality gypsum while operating with a wide range of high sulfur coals. Oxidation is accomplished by an innovative air rotary sparger system.
- The FGD supplier will own and operate the plant for 20 years or more and provide ongoing performance guarantees which will reduce operating risk and cost to utilities and their customers.
- Sale of commercial grade gypsum to a wallboard manufacturer.
- Direct injection of powdered limestone.
- High sulfur dioxide removal efficiency up to 95%.
- Wastewater Evaporation System (WES) which will reduce water disposal problems inherent with many U.S. power plants.

- Multiple boilers to a single absorber module which can significantly reduce costs at power plants with multiple boiler units.

3.2 Process Design Basis

The following tables give the parameters under which the AFGD facility was designed.

3.2.1 Summary of Key Design Parameters

	Min. Load	Min.	Optimum	Performance	Permit	Max.
Sulfur in Coal (%)	2.07	2.07	3.1	3.6	4.51	4.51
Excess Air on Units 7/8 (%)	25/-	35/25	40/40	60/50	60/50	60/50
SO2 Removal	(1)	(1)	(1)	(1)	(2)	(1)
SO2 Uncontrolled Emissions (LB SO2/MMBtu)	3.07	3.07	5.35	6.40	7.8	7.8
Coal HHV (Btu/LB)	12,829	12,829	11,000	11,000	10,982	10,982
Heat Input (MMBtu/hr)	853	5,150	5,000	5,012	5,012	5,150

(1) Guaranteed SO2 Removal = 90% or 0.6 LB/MMBtu, whichever is less stringent.

(2) Permit SO2 removal - 1.2 LB/MMBTU (6,014 LB/hr SO2 Out)

(3) These values are approximate. Process design will be based on the mass flows and the corresponding volumetric flows which will be calculated by MHI.

(4) NI has not selected the coals to be used as the basis for the optimum and minimum cases. These have been chosen by Pure Air based on discussion with NI concerning the probable sulfur content and are being used by MHI to develop parameters for turndown operation. NI has provided information on the excess air and heat input for these cases.

3.2.2 Feed Gas to the FGD Plant

	Min. Load	Min.	Optimum	Performance	Permit	Max.
Excess Air on Units 7/8 (%)	30	25/-	35/25	60/50	60/50	60/50
Inlet Temp., °F	350	350	350	280	350	335
Fly Ash loading with WES not in operation lbs. of fly ash/MMBTU	0.1	0.1	0.1	0.1	0.1	0.1

Units 7/8 LB/MMBtu Maximum combined rate of change is 10 MW per unit per minute (approximately 3.6% per minute of full load).

Composition (lb/hr)

Maximum Case	Unit 7	Unit 8	Total	Typical
SOx	13,250	26,935	40,185	25,000
H2O**	123,250	244,850 (286,087)	368,100 (409,337)	7.7% (vol.)
O2	176,800	298,900	475,700	6.7% (vol.)
CO2	334,500	678,700	1,013,200	12.7% (vol.)
N2	1,557,200	2,984,400	4,541,600	N.A.
HCl	440	885	1,325	151
NOx	3,200	6,300	9,500	N.A.
HF	22	43	65	25
Fly Ash**	170	345 (555)	515 (725)	50

Permit Case (Basis: WES not in operation)	Total
SOx	39,110
H2O	358,250
O2	462,950
CO2	986,050
N2	4,419,900
HCl	1,290
NOx	9,250
HF	63
Fly Ash	515

Performance Case	Unit 7	Unit 8	Total
SOx	10,568	21,482	32,050
H2O**	120,420	239,230	359,650
		(280,467)	(400,887)
O2	186,463	315,237	501,700
CO2	359,805	730,045	1,089,850
N2	1,631,638	3,127,062	4,758,850
HCl	62	126	188
NOx	3,267	6,433	9,700
HF	2	3	5
Fly Ash**	170	345	515
		(555)	(725)

Minimum Case	Unit 7	Unit 8	Total
SOx	5,210	10,565	15,755
H2O**	101,450	201,565	302,500
		(242,287)	(343,737)
O2	165,750	280,200	445,950
CO2	324,850	659,100	983,950
N2	1,458,550	2,774,000	4,232,550
HCl	27	55	82
NOx	2,950	5,650	8,600
HF	14	28	42
Fly Ash**	170	345	515
		(555)	(725)

Minimum Load Case (WES not in operation)	Total
SOx	2,620
H2O	46,700
O2	34,550
CO2	162,900
N2	570,150
HCl	15
NOx	670
HF	7
Fly Ash	85

** Where noted, values in parentheses correspond to the case where the WES is operating. Fly Ash from the ESP on unit 8 = 0.16 LB/MMBtu. H2O flow is increased with the WES in service and does not consider (except in the Maximum case) the chloride concentration in the Absorber slurry. Values not in parentheses for H2O and fly ash refer to flows with the WES out of service.

3.2.3 Process Gas to Customer

The operating permit requires that there be no net increase in particulate loading at the FGD outlet.

	Minimum	Optimum	Permit	Maximum	Typical
Expected Outlet Temp,°F	135	135	135	135	131
Particulate, grains/ACF	0.05	0.05	0.05	0.05	< 0.5
Pressure Range, inches W.C. (at chimney inlet)					2.0

3.2.4 Gypsum Specification

Composition, Weight Percent (dry basis)

$CaSO_4 \bullet 2H2O$	93.0 wt % minimum (95.0 wt % design)

$CaSO_4 \bullet 2H_2O$ concentration will be determined by the following minimum analyses:

- Combined H2O	19.46 minimum per ASTM C471-76
- CaO	30.32 minimum per USG-EDTA
- SO3	43.22 minimum per ASTM C471-76

CaSO3 • 1/2H2O	2.0 maximum
SiO2	2.5 maximum per USG-AA Method for Oxides
Fe2O3	1.5 maximum per USG-AA Method for Oxides
R2O3 (Total Metal Oxides)	3.5 maximum per USG-AA Method for Oxides

Composition, Parts per Million by Weight (dry basis)

Cl	120 maximum (100 design)
Total Water-Soluble Salts	600 Maximum

Other Specifications

pH	Range of 5 - 8.7 per USG Method 113
Mean Particle Size, micron	20 minimum per Sedigraph 5000D plus sieve analysis
Free Water, weight percent	10 maximum (dried at 43.3 °C)

3.2.5 Water Supply Specification (Boundary Limits)

NI cannot guarantee these values but is prepared to work with Pure Air to review information and conduct testing.

		Avg.	Max.*
A.	Pressure, psig	100	150
B.	Cl^-, mg/l as Cl		28.9
C.	Total Dissolved Solids, ppm		445

* Values can be exceeded 1% of time each year.

Pure Air is to comply with all state and federal regulations for oil disposal. NI has pointed out that normal wash downs do not require oil-water separators.

Table 2.5.1 contains historical data on the quality of the water supply and is provided for reference only.

3.2.6 Wastewater (Boundary Limit)

The following wastewater quality shall be maintained.

Cl^-,	ppm	30,000 Max.
Ca^{2+},	ppm	12,000 Max.
Mg^{2+},	ppm	6,000 Max.
F^-,	ppm	1,100 Max.
$SO4^2$,	ppm	2,500 Max.
TDS,	ppm	100,000 Max.
TSS,	ppm	30 Max.

3.2.7 Power Supply Specifications

Power Usage connected load
use at optimized conditions: 8,250 kW
use at maximum conditions: 8,650 kW

Power Factor NI does not have a specific power factor requirement for the FGD facility.

3.2.8 Limestone Supply

Specifications

-	$CaCO_3$	96.5% (minimum)
-	SiO_2 plus insolubles, max	2.0%
-	Fe_2O_3, max	1.0%
-	$MgCO_3$, max	1.5%
-	Al_2O_3, max	0.1%
	Size	325 mesh, 95% pass
	Moisture	0.2%

3.2.9 Coal Composition

NI assumes that the range of values specified in this table are representative of the type of coal which would be burned subsequent to installation of the FGD Facility.

	Minimum	Typical	Permit	Maximum
S, wt %	2.07	3.14	4.51	4.51
C, wt %	66.72		58.81	58.81
H, wt %	4.65		4.46	4.46
H_2O, wt %	6.20	12.8	13.50	13.50
N, wt %	0.33		1.14	1.14
Cl, wt %	0.02	< 0.25	0.25	0.25
Ash, wt %	By Diff.	10.46	By Diff.	By Diff.
O, wt %	9.39		7.08	7.08
F, ppmw	100	< 120	120	120

NI has not selected the coals to be used as the basis for the optimum and minimum cases. These have been chosen by Pure Air based on discussions with NI concerning the probable sulfur content and are being used by MHI to develop parameters for turndown operation.

3.3 System Description

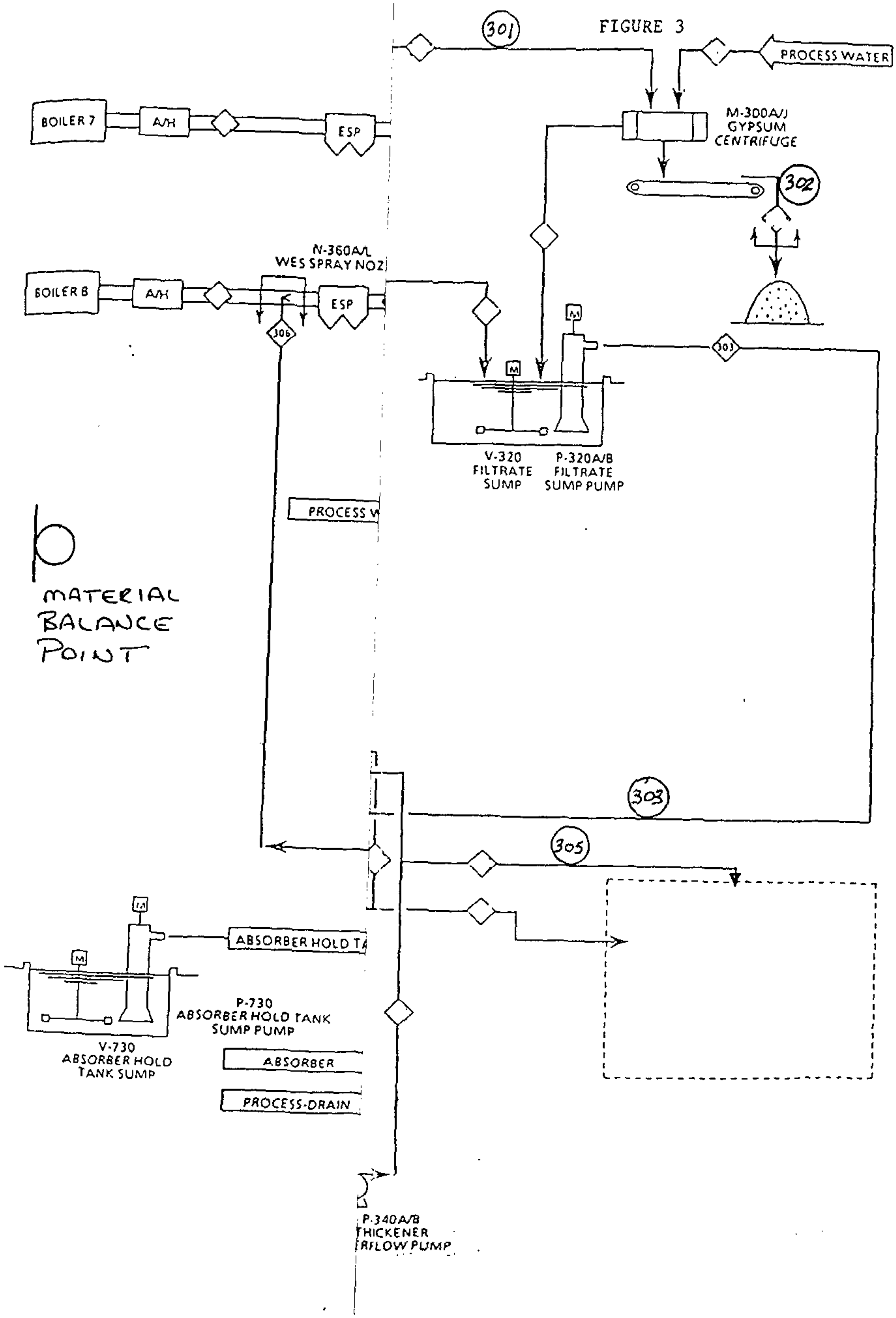
3.3.1 System Division

This Flue Gas Desulfurization (SO_2 removal) facility consists of the following sections:

Section 100	Absorption Section
Section 300	Dewatering, Gypsum Handling and Wastewater Evaporation Section
Section 500	Limestone Feed Section
Section 600	Utility Section
Section 700	Sump Section
Section 800	Hydrated Lime Feed Section

PROCESS FLOW DIAGRAM

FIGURE 3



3.3.2 Process Description

Section 100 Absorption Section

Major Equipment

Absorber	T-120
Air Rotary Spargers	A-120A/C
Fixed Air Sparger	A-120D
Oxidation Agitators	A-140A/B
Neutralization Agitators	A-130A/B
Absorber Recirculation Pumps	P-120A/L
Absorber Bleed Pumps	P-125A/B
Oxidation air blowers	B-110A/D
Mist Eliminator	E-120

Flue Gas

The FGD system is separated from the NI ductwork by guillotine dampers supplied by NI. The flow schematic is shown in Figures 3a&b. Each boiler is supplied with a damper to the existing stack, designated the FGD bypass, and an FGD inlet damper to the Pure Air system. Operation of the dampers is under NI control.

Flue Gas exiting the ID fans is monitored for pressure, temperature, opacity and SO2 concentration and displayed on the DCS★. A series of flow measuring probes is used to approximate the Flue Gas flow rate. This signal, along with signals from NI for Boiler Load, Air Flow and the SO2 analysis, forms the basis for the FGD load calculation. Flue Gas leaving the Absorber is also monitored for pressure, temperature and SO2 levels.

★ **DISTRIBUTED CONTROL SYSTEM**

Absorber and Ancillaries

Absorber

The single 100 percent Absorber (T-120) is a co-current flow grid-packed tower with a combined Reaction Tank at the bottom designed to incorporate humidification of the incoming gas, absorption of the SO_2, dissociation of the sulfurous acid, oxidation to sulfuric acid, crystallization to form Gypsum (with simultaneous oxidation of sulfite into sulfate), and neutralization with limestone. The Flue Gas enters the top of the Absorber where it contacts with recirculating slurry. The area directly above the sprays, called the Wet/Dry Interface, receives a wash with process water to prevent the formation and growth of any deposits. Grid packing (made of a plastic polymer) is located at an intermediate portion of the tower to provide a large surface area for gas/liquid contact to enhance the SO_2 removal efficiency.

The SO_2 in the Flue Gas is absorbed into the recirculating slurry as the gas flows downward through the tower. The absorbed SO_2 is partially oxidized in the Absorber by oxygen in the Flue Gas. Complete oxidation is accomplished in the Reaction Tank. After flowing through the Absorber tower, the Flue Gas turns over the Reaction Tank and then upwards and through the Mist Eliminator (E-120) located vertically in the outlet duct.

To ensure the complete oxidation of calcium sulfite, oxidation air is injected with an air sparging system consisting of three (3) Air Rotary Spargers (A-120A/C) and a Fixed Air Sparger (A-120D). The Air Rotary Sparger (ARS) is an innovative and unique device which combines agitation with oxidation. The ARS is composed of a hollow shaft, incorporating four horizontal arms with holes for air sparging. By the rotation of the ARS and the introduction of feed air, fine bubbles are formed. This increases the contact area between air and slurry and results in high O2 utilization efficiency.

The Fixed Air Sparger is located near the bottom of the tank. It is composed of a piping network of high-velocity nozzles which enable the formation of fine air bubbles and so forces complete oxidation before the recirculating slurry passes from the Oxidation Tank to the Neutralization Tank. This Sparger can ensure uniform distribution of air bubbles throughout its length. The majority of the Sulfur Oxides in the slurry are oxidized by the three (3) ARSs with the remainder being oxidized by the Fixed Air Sparger before leaving the Oxidation Tank.

3.3 PROCESS CHEMISTRY

The chemistry of SO_2 absorption from the Flue Gas and its conversion into Gypsum is as follows. First, in the Absorber tower:

$$SO_2 + H_2O \rightarrow H_2SO_3$$
$$H_2SO_3 \rightarrow H^+ + HSO_3^-$$
$$(H^+ + HSO_3^- + \tfrac{1}{2}O_2 \rightarrow 2H^+ + SO_4^{-2})$$
$$(2H^+ + SO_4^{-2} + CaCO_3 + H_2O \rightarrow CaSO_4 * 2H_2O + CO_2)$$

The SO_2 is absorbed into H_2O, then it dissociates from H_2SO_3 to H^+ + HSO_3^-. A portion of the HSO_3^- is oxidized by oxygen in the Flue Gas and is converted into H_2SO_4 (sulfuric acid). The $CaCO_3$ (calcium carbonate) in the slurry neutralizes a portion of the H_2SO_4, helping to balance the slurry pH. The conversion to Gypsum is completed:

$$H^+ + HSO_3^- + \tfrac{1}{2}O_2 \rightarrow 2H^+ + SO_4^{-2}$$
$$2H^+ + SO_4^{-2} + CaCO_3 + H_2O \rightarrow CaSO_4 * 2H_2O + CO_2$$

All remaining HSO_3^- in the slurry is oxidized by air from either the ARS's or the Fixed Air Sparger and converted into H_2SO_4. It is then neutralized with $CaCO_3$ to form $CaSO_4 * 2H_2O$.

Surplus $CaCO_3$ is suspended in the slurry which provides a source of carbonated ion through dissolution as the carbonate is consumed and acts to maintain the pH of the slurry. The resultant slurry, in which the concentration of SO_2 or SO_3^{-2} is almost nil, is pumped back up to the top of the Absorber to contact with the Flue Gas. The chemical reaction of SO_2 absorption is then repeated. To compensate for the calcium carbonate used in the process, pulverized limestone is pneumatically injected into the Neutralization Tank through piping from the limestone feed area.

The Absorber module has two tiers of spray headers with each tier having an independent slurry recirculation line. Six Absorber Recirculating Pumps (P-120) are connected to each recirculation line. The number of recirculating pumps in use depends on plant operating conditions.

The SO_2 concentration in the Flue Gas leaving the Absorber is monitored and controlled by regulating the number of Recirculating Pumps running and by the amount of limestone injected into the Neutralization Tank. In order to ensure the stable operation of the centrifuges and prevent scaling, the Gypsum slurry concentration in the Oxidation Tank is maintained at 20 to 25 weight percent.

Water in the Reaction Tank is consumed through evaporation into the Flue Gas and as water of hydration during Gypsum formation. With the loss of water, the addition of limestone and the formation of Gypsum, the slurry concentration in the Oxidation Tank increases. This slurry concentration is monitored by a density meter, and on a demand signal from it fresh make-up water is added to the absorber tank.

Oxidation Air Blowers

Four oxidation air blowers (B-110A/D) are provided to supply the oxidation air to the ARSs and the Fixed Air Sparger (FAS). The air flow rate to the Spargers is controlled by FIC-344 for the FAS and FIC-345 for the ARSs. The controller setpoints are automatically calculated by the DCS depending on the process air requirements.

Flue Gas exiting the Absorber enters a vertical Mist Eliminator located in the outlet duct leading from the reaction tank. An intermittent spray water washing system is installed in front of both stages of the mist elements and at the rear side of the first stage, to wash the elements and reduce Gypsum deposit buildup. After passing through the Mist Eliminators, the scrubbed Flue Gas exits through the outlet duct to the new NI stack.

3.2.2 Section 300 Dewatering Section

The gypsum slurry drawn off by the Absorber bleed pump is fed to the V-370 Centrifuge Feed Tank. From this tank it is then pumped by the P-370A/B Centrifuge Feed Pump(s) to the Centrifuge Head Tank (V-300), which is located above the centrifuge feed slurry header, to ensure stable back pressure and a constant feed rate to the centrifuges.

The Bailey DCS Batch program coordinates the choice of centrifuges to be operated. Nine basket type centrifuges (M-300A/I) are provided to reduce the gypsum slurry to a dewatered cake containing less than 10 percent moisture by weight.

The cake washing cycle is part of the centrifuge operating cycle. Cake is washed with process water to reduce the chloride content to less than 120 ppm, which meets the requirement of wall board manufacturers. Upon completion of the drying cycle, the gypsum cake is scraped out of the centrifuge onto a conveyor and sent to storage.

During the feed, dewatering, and washing cycles, Filtrate water is drained from the centrifuges and collected in the Filtrate Sump. The liquid collected in the Thickener Overflow Tank is recycled to the Absorber tank to be used as process make-up water.

Filtrate water produced by the dewatering process is recycled and used as make-up water. Before it is returned back to the Absorber, fly ash and impurities suspended in the Filtrate water are removed in order to avoid the accumulation of such materials in the slurry. For this purpose, Filtrate water is sent to the Filtrate Thickener (V-330) for solids separation.

In the Filtrate Thickener, the supernatant with suspended solid content of less than 500 ppm, overflows the weir and collects in the Thickener Overflow Tank (V-340). Sediment is raked out and pumped to the Centrifuge Feed Tank via the Thickener Underflow Pump where it is combined with the Absorber bleed slurry flow. Fly ash is recovered as a component of the by-product gypsum. In the event that the fly ash is not recovered in the by-product gypsum, it accumulates in the dewatering loop. Since this may have an adverse effect on dewatering performance and/or gypsum quality, the Thickener underflow line is piped to the WWTP.

A portion of the Thickener overflow is not recycled but discharged to either the Wastewater Treatment Plant or the Wastewater Evaporation System (WES). This is done to avoid the accumulation of surplus impurities in the process, especially chlorides. The accumulation of chlorides in the slurry negatively impacts Absorber performance and gypsum quality, and increases the risk of metal surface corrosion. The total wastewater quantity discharged is controlled so that the maximum chloride concentration in the slurry is less than 20,000 ppm. The boiler load signal is used to control the chloride level since most of the chloride comes from the Flue Gas. The total amount of chloride supplied is proportional to the flue gas flow rate. The following flows are taken into account as wastewater flow quantity:

a. Thickener underflow to the wastewater treatment facility.

b. Thickener overflow to the wastewater treatment facility.

c. WES system supply flow

The amount of wastewater discharged is controlled so that the sum of the above flow rates becomes the target value which is calculated based on the boiler load signal.

Wastewater Evaporation System (WES)

Wastewater is sent to the WES (at 850 psig) by the P-350 wastewater pump. Two flue gas ducts are branched from the outlet of the air heater of No. 8 boiler unit and led to the ESPs. The WES nozzles are located inside the flue gas duct between the air heater and the electrostatic precipitators. There are six WES nozzles in each of these ducts (a total of 12), and they are installed upstream of the ESPs.

Wastewater is sprayed through the WES nozzles to form a fine mist and then mixed with the flue gas. The fine mist is evaporated by the heat energy of the flue gas and both the suspended and dissolved particles are dried to solids and removed by the ESPs together with other fly ash. Since spray water robs heat energy from the flue gas during evaporation, the quantity of spray water is restricted so that the downstream temperature remains high enough to protect the duct surface against sulfuric acid attack. The quantity of spray water is controlled by the number of WES nozzles in use. The start-up/shutdown of every WES nozzle is sequentially controlled by a remote signal from the DCS.

Section 500 Limestone Feed Section

Major Equipment

Limestone Silos V-500A/B

Limestone Rotary Feeders M-500A/B

Limestone Transfer Blowers B-510A/B

Limestone Unloading Blowers B-520A/C

Limestone Feed Pumps M-530A/B

Limestone Dust Collector and Fan M-540A/B

Limestone Unloading and Storage

Limestone, supplied by truck in a pulverized form, is pneumatically unloaded to the limestone silos (V-500A/B) by the limestone unloading blowers (B-520A/C). To avoid bridge formation of the stored limestone in the silos, and to fluidize it for smooth discharge, compressed air is injected into the silos intermittently from the B-810A/C aeration-airslide recirculation blowers along the bottom plate of the silos. See Figures 3.2.3.1 and 3.2.3.2.

Limestone Feed

The limestone feed rate to the Absorber is controlled to maintain the FGD outlet SO2 concentration in the gas within the pre-set value. Upon receiving the demand signal from the control circuit, limestone is discharged from the bottom of a silo by rotary feeder and the feed rate is changed by varying the rotating speed of the feeder.

Limestone discharged by the feeder is gravity fed to a screw pump where it is then pneumatically transferred to the Absorber with the help of the compressed air supplied by the limestone transfer compressors (B-510A/B). Limestone injection nozzles are provided at the neutralizing section of the Absorber tank and dipped into the slurry to allow pulverized limestone to be mixed with the slurry

There are two independent limestone transfer systems that include piping, screw pumps, and limestone injection nozzles. This establishes a completely redundant system. Figure 3.2.3.3

Equipment List

Limestone Silos V-500A/b

Limestone Rotary Feeders M-500A/B

Limestone Transfer Blowers B-510A/B

Limestone Unloading Blowers M-520A/B

Limestone Feed Pumps M-530A/B

Limestone Dust Collector and Fan M-540A/B

Section 600 Utility Section

Major Equipment

Instrument Air Compressors K-600A/B

Instrument Air Dryers M-600A/B

Inhibited Cooling Water Pumps P-610A/B

Process Water

Process Water is supplied by NI to the battery limit where it passes through a duplex filter (ST-1) to eliminate large particles and then it is distributed as follows:

- Absorber Tank make-up
- Mist eliminator washing
- Wet/Dry interface washing
- Centrifuge cake washing
- ARS and fixed sparger nozzle washing
- Analyzer/instrument washing
- Process line flushing
- Pump sealing
- Utility stations

Prior to being supplied for the wet/dry interface wash and pump sealing, process water is passed through a cyclone self cleaning screen and duplex strainer to eliminate the fine particles and thereby avoid nozzle plugging and protect the pumps from damage.

Potable Water

Potable Water is used to supply all of the water needs in the Administration Building as well as the safety showers and eye-wash stations throughout the facility. This water comes from wells drilled in the area of the Administration Building (there is one North and one South of the building). Their combined flow is 50 gallons per minute. Submersible well pumps are used to pump the water from the wells to the building and maintain the system pressure at about 45 psig.

To purify the water, a water treatment system is use and it consists of cyclone separators, sand filters and a water softener. The cyclone separators are designed to remove sand and other suspended particles from the water.

The Wastewater Treatment Plant has a potable water system provided to it by NI. Safety showers and eye-wash stations are provided in the chemical storage area. It is recognized that the supply of emergency showers and eye-wash stations from wells cannot be 100% guaranteed. In dry summers the water table level may fall and, of course, a well pump may fail. For this reason, an emergency back-up system has been installed. The potable water system in the WWTP is tied into the potable water system in the dewatering building. In this way, a low pressure condition in the PA system will be detected by a pressure switch, which will then open a solenoid operated valve in the tie-in line, and join the two systems together. A backflow preventer ensures that water from our system cannot flow into NI's system.

Inhibited Cooling Water System

This plant utilizes a closed loop cooling water system which consists of two coolers (H-610A&B), two circulation pumps (P-600A and P-600B), an expansion tank (V-610) and a piping network. The make-up water for this system comes from the process water. The system provides cooling for the instrument air compressors and the oxidation air blower lube oil coolers.

Instrument Air System

Plant operating, control and utility air is provided by two (100% each) sets of instrument air compressors, two (100% each) dryer units with prefilters, afterfilters and the dryers themselves, a surge vessel (1060 ft^3 volume) and a pressure relief device on the surge vessel set at 150 psig. Only one compressor and one dryer system is on-line at a time, the other unit is on standby.

A continuous Dew Point monitoring system is in place. It insures that we maintain a very low moisture content (-40°F Dewpoint) in the instrument air system by continually verifying that the air dryers are functioning properly. In the event that we experience a moisture breakthrough, the moisture analyzer will issue an alarm to the control room.

Emergency Quench System

The emergency quench system is provided to protect the Absorber from being damaged by excessive heat during an upset condition such as a total power outage, the Absorber recirculation pumps trip etc. This happens when hot flue gas enters the Absorber while there is insufficient quenching water available. There are three hard wired temperature switches, installed on the outlet of the mist eliminator to detect this condition. As soon as this occurs, a trip signal is initiated by a 2 out of 3 voting system of these temperature switches. This method of initiation safeguards against an accidental shutdown of the FGD caused by any instrument malfunction. With this signal, the main diesel quench pump switches on and NV-124 opens automatically to commence spraying through the nozzles located at the Absorber duct inlet. Meanwhile, the same signal is sent to NIPSCO's power station requesting closure of the inlet guillotine dampers and opening of the by-pass dampers.

Equipment List

Instrument Air Compressor	K-600A/B
Instrument Air Dryers	M-600A/B
Inhibited Cooling Water Pumps	P-610A/B

Section 700 Sump Section

<u>Major Equipment</u>

Absorber Sump Agitator A-700

Absorber Sump Pumps P-700A/B

Absorber Sump V-700

Absorber Hold Tank Agitator A-710

Absorber Hold Tank Pump P-710

Absorber Hold Tank V-710

Thickener Sump Agitator A-720

Thickener Sump Pump P-720

Thickener Sump V-720

Absorber Hold Tank Sump Agitator A-730

Absorber Hold Tank Sump Pump P-730

Absorber Hold Tank Sump V-730

Absorber Hold Tank/Absorber Hold Tank Sump

The Absorber Hold Tank (V-710) is provided to receive and hold slurry in the event that,

- the Absorber is to be drained or
- wastewater from the Thickener overflow and/or underflow cannot be discharged to the wastewater treatment plant while the plant is operating or

- the dewatering system is out of service while the plant is operating or
- a large amount of slurry is needed to be stored for some other reason.

Under such conditions, depending on valve arrangements, slurry can be sent to the Absorber Hold Tank. Conversely, slurry in the Hold Tank can be transferred to the Absorber and/or the Centrifuge Feed Tank by the P-710 Absorber Hold Tank Pump or through the V-730 Absorber Hold Tank Sump to the V-700 Absorber Sump and then to the Absorber. Adjacent to the Absorber Hold Tank, the Absorber Hold Tank Sump (V-730) is provided to collect the Hold Tank drain and other drains around the sump.

Absorber Sump

The V-700 Absorber Sump is generally used for drains from the pH, SO3 & CO3 analyzers and process drains from the Absorber and Recirculating pump areas. These collected drains are pumped by the Absorber Sump Pump (P-700A/B) to the Absorber. When the Absorber is to be drained, valves 117 & 118 are opened and while the Absorber is draining into the sump, the Absorber Sump Pumps are pumping to the Absorber Hold Tank. The Absorber Sump Pumps start and stop automatically to control the sump level. If the level reaches a high high position while one pump is running, the stand-by pump starts automatically.

3.2.5.3 Thickener Sump

The Thickener Sump (V-720) is located beneath the Filtrate Thickener. Usually, floor drains such as pump sealing water spillage and flushing water are flowing into this sump. Once the liquid level in this sump reaches a high level setpoint, the Thickener Sump Pump (P-720) automatically starts and the liquid is pumped to the Filtrate Thickener. When it becomes necessary to drain out the Thickener, the liquid is stored in this sump.

In a situation where the Thickener underflow slurry cannot be sent to either the wastewater treatment plant or recycled to the Centrifuge Feed Tank but plant operation has to be continued, slurry is sent to this sump. If required, the slurry can be transferred to the Absorber Hold Tank through the Thickener Sump Pump (V-720) to allow longer operation.

3.2.5.4 Equipment List

Absorber Hold Tank V-710

Absorber Hold Tank agitator A-710

Absorber Hold Tank Pump P-710

Absorber Sump V-700

Absorber Sump Agitator A-700

Absorber Sump Pumps P-700A/B

Thickener Sump V-720

Thickener Sump Agitator A-720

Thickener Sump Pump P-720A

Absorber Hold Tank Sump V-730

Absorber Hold Tank Sump Agitator A-730

Absorber Hold Tank Sump Pump P-730

Section 800 Hydrated Lime Feed Section

Major Equipment

Hydrated Lime Rotary Feeder M-800

Hydrated Lime Silo V-800

Hydrated Lime Injection Tank Agitators A-810A/B

Aeration Air Slide Recirculation/Transfer Blowers B-810A/B

Hydrated Lime Injection Tanks V-810A/B

Neutralization Pumps P-811A/B

Hydrated Lime Silo Dust Collector and Fan M-840

Hydrated Lime Unloading and Storage

Hydrated Lime is supplied by truck in a pulverized form and pneumatically unloaded to the Hydrated Lime Silo (V-800) by operating the unloading blower mounted on the truck. Hydrated Lime, because of its characteristic nature, absorbs atmospheric moisture and gradually loses much of its fluidity during its storage in a silo. To avoid the above phenomenon, a Hydrated Lime recirculation system is provided. The recirculation system activates automatically once the manually initiated start command is given.

Hydrated Lime Feed to the Hydrated Lime Injection Tank

Normally, Hydrated Lime is supplied to the V-810A/B Hydrated Lime injection tanks where it is used to neutralize the Filtrate water discharged from the centrifuges. In the these tanks, Hydrated Lime is mixed with water to form a 10 wt% slurry. Upon receiving a signal from AIC-190, the neutralizing slurry is pumped to the Filtrate Sump V-320. The two tanks are used alternately so that when one tank becomes empty, the other tank is put into service and the empty tank gets refilled.

Hydrated Lime Feed to the Absorber

During normal operation, the concentration of fly ash in the slurry is kept below 2 g/l, to avoid any reduction in limestone reactivity. If the fly ash concentration increases it reduces limestone reactivity and appears as an increase in the outlet SO2 concentration as well as in a reduction in the pH value of the Absorber recirculating slurry.

This situation can happen if a large amount of fly ash is introduced into the Absorber as a result of an upset of the electrostatic precipitator (ESP), fly ash is accumulated in the process due to a malfunction of the Thickener, or a misoperation.

Once limestone reactivity is inhibited, it can not be improved by the addition of surplus limestone. The only way improvement can be made is by the addition of a strong alkali. For this purpose, a Hydrated Lime feed system is incorporated in this plant. As soon as the above situation develops, the Hydrated Lime feed system is put into service.

Hydrated Lime is raked out of the silo by a rotary feeder and fed to the screw pump (M-530A or B) under operation via an airslide conveyor and then pneumatically transferred to the Absorber together with the limestone powder. Between the airslides and the M-530A/B hoppers is a manual knife gate for circuit isolation and to prevent pressure feedback between the two airslides. The feed rate is changed by varying the speed of the rotary feeder and the feed rate is controlled by the signal which is integrated in the sulfur emission control loop. During the Hydrated Lime feeding period, the limestone feed rate is adjusted to compensate the required amount of alkali according to the process condition. The control method for this procedure is discussed in a later section. Figure 3.2.6.3

Equipment List

Hydrated Lime Silo V-800

Hydrated Lime Rotary Feeder M-800

Hydrated Lime Silo Dust Collector M-840

Aeration-Airslide Recirculation/Transfer Blowers B-810A/C

Hydrated Lime Injection Tanks V-810A/B

Hydrated Lime Injection Tank Agitators A-810A/B

Neutralization Pumps P-811A/B

4.0 TEST CONDITIONS

4.1 TEST PLAN

DOE DEMONSTRATION TEST PLAN

Introduction

The Demonstration Tests consist of six (6) testing periods with specific ranges of sulfur content in the coal. The test duration and sequence are shown below.

Demonstration Test No.	Coal Sulfur Content wt. %	Duration of Test # of Days
I	<2.5	30
II	2.5 - 3.0	30
III	3.0 - 3.5	30
IV	3.5 - 4.0	30
V	>4.0	15
VI	Optimum	50

Test VI will demonstrate the operation of the AFGD system under optimum conditions as determined by previous testing. Tests I-IV can be performed in any sequence.

In addition to the functional coal related demonstration tests, other testing will be performed to demonstrate the endurance of the AFGD facility. The testing is to be broken up as follows.

Endurance Test No.	Evaluation	Duration of Test Weeks/Year	Year
A_1, A_2, A_3	Normal	40	1, 2, 3
B_1, B_2, B_3	WES	2	1, 2, 3
C_1, C_2, C_3	Maintenance	52	1, 2, 3

The details of each demonstration test and the endurance tests are listed in the following text.

SAMPLING AND TESTING PHILOSOPHY

The sampling and chemical testing will be run so that a material balance may be established, as well as the status of the concentrations of major and trace components. The concentrations of some components will change on a daily basis, while other components will change slowly over the course of the testing program. The sampling schedule will be adjusted to optimize the sampling tasks and analysis. The schedules of sampling and analysis are for illustration only and will be adjusted as needed.

4.2 Test Description

The test program was conducted within the constraints of a plant under commercial operation with the requirements of meeting the purity specifications of Gypsum and also meeting all regulatory requirements as to environmental emissions. Each test was run under a test plan, which documented process requirements and sampling requirements for the test.

Department of Energy

Demonstration Plan

Demonstration Test III

REV NO.	DATE	DESCRIPTION	CHECKED	DATE	APPRVD	DATE

	INITIALS	DATE	
APPRVD			CUSTOMER Northern Indiana
CHECKED			PROJECT Bailly 600 MW AFGD
DRAWN	GBM	4/2/92	DRAWING NUMBER: 9-6992-DOE-002-F; REVISION: 2
ISSUED			
PURE AIR			FILE; CABINET

DOE DEMONSTRATION TEST PLAN

Demonstration Test No. III:

Objective: Evaluate the effect of L/G ratio and oxidation air flow to the Air Rotary Sparger (ARS) on the overall system performance, including SO_2 removal efficiency, slurry composition and by-product gypsum quality.

Test: Demonstration with Test No. III consists of Northern Indiana burning coal greater than 3.0 wt. % sulfur and less than 3.5 wt. % sulfur for a period of one month. At the maximum load condition, the L/G will be kept constant and the Ca/S ratio will be varied from 1.01 to 1.05. The overall system performance will be measured, including SO_2 removal efficiency, slurry composition and by-product gypsum quality.

During the L/G testing, the equivalent MW load to the scrubber will be varied from minimum load on Unit #7 to maximum load (Unit #7 and Unit #8 at MCR). There will be three boiler load conditions (33%, 67%, 100%) during this test. The liquid to gas ratio (L/G) will be varied from a minimum to the maximum and data on overall system performance taken at six L/G conditions (6, 7, 8, 9, 10, 11 pumps in operation). At lower loads, and lower sulfur concentrations, the changes in SO_2 removal by the addition of pumps is expected to be negligible. At times when no significant change in SO_2 removal is observed, the test will be stopped. The Ca/S ratio will be kept constant (1.03) during this test, so as to maintain 95% gypsum purity.

At the boiler load conditions, the air flow rate will be varied to the ARS. The air will be varied from a minimum to a maximum depending on boiler load and sulfur content. The effect that this depletion of air to the ARS has on the overall system performance will be evaluated.

At the maximum load case (100%), the test will be held for longer periods of time and stack testing will be included in the overall analysis. During all other periods of testing, the continuous emissions monitoring system (CEMS) will be used to close the material balance for the facility.

The specifics of number of tests, type of analysis, location and frequency of samples for both the slurry and gas testing to be performed can be found in the attached documentation entitled, Demonstration Test III Test Matrix.

Expected Results:

Ca/S Ratio: A curve is provided for the expected SO_2 removal efficiency as a function of the Ca/S ratio. Pure Air will place the actual measured point on this curve for comparison at the conclusion of the testing period.

L/G Analysis: For each boiler load condition, the effect of L/G on SO_2 removal has been predicted. Pure Air will place the measured data on this curve for comparison at the conclusion of the testing period.

ARS Results: The ARS oxidation efficiency and oxygen utilization will be provided as a % of design and as a function of sulfur load (% of design).

In addition, the effect that this change has on process chemistry and SO_2 removal will be documented.

Material Balances: Material balances will be provided for each testing period.

Department of Energy

Demonstration Plan

Demonstration Test III

Test Matrix

REV NO.	DATE	DESCRIPTION	CHECKED	DATE	APPRVD	DATE

	INITIALS	DATE	
APPRVD			CUSTOMER **Northern Indiana**
CHECKED			PROJECT **Bailly 600 MW AFGD**
DRAWN	GBM	4/2/92	DRAWING NUMBER **9-6992-DOE-002-F** REVISION **2**
ISSUED			
PURE AIR			FILE CABINET

Demonstration Test Plan

Demonstration Test: 3
Coal Description: C
Sulfur Concentration: 3.25 wt%

Objectives:
-Measure the effect of Ca/S ratio on overall system performance.
-Measure the effect of the liquid to gas ratio (L/G) on sulfur dioxide removal and byproduct quality.
-Measure the oxidation performance of the ARS and its effect on overall system performance.

	Test No.	Boiler Conditions FGD Load (MW)	Boiler Conditions Unit #7 Load (MW)	Boiler Conditions Unit #8 Load (MW)	Liquid Rate (gpm)	ARS Air Rate (SCFM)	SO2 Inlet Conc (lb/MMBTU)	Ca/S Ratio	Exp SO2 Outlet Conc (lb/MMBTU)	Expected Gypsum Purity %	No. Liquid Samples	No. Gas Samples	Test (Hrs)
Ca/S	1	466	156	310	242,150	9,760	5.91	1.01	0.16	96	14	2x3	12
Ca/S	2	466	156	310	242,150	9,760	5.91	1.02	0.16	96	14	2x3	12
Ca/S-AR	3	466	156	310	242,150	9,760	5.91	1.03	0.16	96	14	2x3	12
Ca/S	4	466	156	310	242,150	9,760	5.91	1.04	0.13	95	14	0	12
Ca/S	5	466	156	310	242,150	9,760	5.91	1.05	0.10	94	14	0	12
L/G	6	466	156	310	242,150	9,000	5.91	1.03	0.60	95	14	0	12
L/G	7	466	156	310	242,150	6,500	5.91	1.03	0.60	95	14	0	12
L/G	8	466	156	310	220,140	9,760	5.91	1.03	0.60	95	14	0	12
L/G	9	466	156	310	198,120	9,760	5.91	1.03	0.60	95	14	0	12
L/G	10	466	156	310	176,109	9,760	5.91	1.03	0.60	95	14	0	12
L/G	11	466	156	310	154,095	9,760	5.91	1.03	0.60	95	14	0	12
L/G	12	466	156	310	132,080	9,760	5.91	1.03	0.60	95	14	0	12
L/G	13	310	0	310	242,150	9,760	5.91	1.03	0.60	95	14	2x3	12
ARS	14	310	0	310	242,150	8,000	5.91	1.03	0.60	95	11	0	12
ARS	15	310	0	310	242,150	6,500	5.91	1.03	0.60	95	11	0	12
ARS	16	310	0	310	242,150	9,760	5.91	1.03	0.60	95	11	0	12
L/G	17	310	0	310	220,140	9,760	5.91	1.03	0.60	95	14	0	12
L/G	18	310	0	310	198,120	9,760	5.91	1.03	0.60	95	14	0	12
L/G	19	310	0	310	176,109	9,760	5.91	1.03	0.60	95	14	0	12
L/G	20	310	0	310	154,095	9,760	5.91	1.03	0.60	95	14	0	12
L/G	21	310	0	310	132,080	9,760	4.23	1.03	0.60	95	14	0	12
ARS	22	156	156	0	242,150	9,760	4.23	1.03	0.60	95	11	2x3	12
L/G	23	156	156	0	176,109	9,760	4.23	1.03	0.60	95	14	0	12
L/G	24	156	156	0	154,095	9,760	4.23	1.03	0.60	95	14	0	12
L/G	25	156	156	0	132,080	9,760	4.23	1.03	0.60	95	14	0	12
ARS	26	156	156	0	242,150	6,490	4.23	1.03	0.60	95	11	0	12
ARS	27	156	156	0	242,150	3,200	4.23	1.03	0.60	95	11	0	12

Demonstration Test: 3
Coal Description: C
Sulfur Concentration: 3.25 wt%

Slurry Analytical Matrix And Sampling Frequency - L/G

Sample Per Test Period (Per Day)

Sample Location	Sample	pH	Temp Deg F	Wt% Solids	Total Analysis		Major Cations	Major Anions	Trace Species	Particle Size Distrib.	Number of Samples
Absorber Bleed Pump	Slurry	3	3	3	3	Liquid	3	3	1/7 day		3/day
						Solid				1-E	
Centrifuge Conveyor	Solid			2	2	Solid		1	1/7 day	1-E	2/day
Centrifuge Centrate	Liquid ~2% Solid	3	3	3	3	Liquid	1	1	1/7 day		3/day
						Solid				1-E	
Thickener Overflow Pump	Liquid	3	3	3	1	Liquid	1	1	1/7 day		3/day
Thickener Underflow Pump	Slurry	3	3	3	1	Liquid	1	1	1/7 day		3/day
						Solid				1-E	
Limestone Silo	Solid							1/demo test	1/demo test	1/demo test	1/demo test
										Total	11

Major Cations: Ca, Mg
Major Anions: F, Cl, NO3, SO3, SO4, CO3
Trace Species: Al, Mn, Si, Fe, Na, K
Total Analysis: Ca, S, SO3, CO2, Mg

E - At End of Testing Period

Demonstration Test Plan

Demonstration Test: 3
Coal Description: C
Sulfur Concentration: 3.25 wt%

Slurry Analytical Matrix And Sampling Frequency - ARS

Sample Per Test Period (Per Day)

Sample Location	Sample	pH	Temp Deg F	Wt% Solids	Total Analysis		Major Cations	Major Anions	Trace Species	Particle Size Distrib.	Number of Samples
Absorber Bleed Pump	Slurry	3	3	3	3	Liquid	3	3	1/7 day		3/day
						Solid				1-E	
Centrifuge Conveyor	Solid			2	2	Solid	1	1	1/7 day	1-E	2/day
Thickener Overflow Pump	Liquid	3	3	3	1	Liquid	1	1			3/day
Thickener Underflow Pump	Slurry	3	3	3	1	Liquid	1	1			3/day
						Solid			1/7 day		
										Total	11

Major Cations: Ca, Mg
Major Anions: F, Cl, NO3, SO3, SO4, CO3
Trace Species: Al, Mn, Si, Fe, Na, K
Total Analysis: Ca, S, SO3, CO2, Mg

E - At End of Testing Period

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 wt% S Coal - WES Out of Service

GAS STREAMS

STREAM NO. DESCRIPTION	A UNIT #7 INLET	B UNIT #8 INLET	D ABSORBER INLET	E ABSORBER OUTLET	H ARS AIR
FLOW, LB/H					
N2					
O2					
CO2					
SO2					
HCL					
HF					
H2O					
TOTAL, LB/H					
TEMP, DEG F					
PRESSURE, IN WC					
FLY ASH, LB/MMBTU					
FLOW, ACFM					

SAMPLE

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. i wt% S Coal - WES Out of Service

LIQUID STREAMS

STREAM NO. DESCRIPTION	101 ABS RECYLCE	102 ABS BLEED	103 CENT FEED	301 GYPSUM PRODUCT	302 CENT OVRFLW	304 THICK OVRFLW	305 THICK UNDRFLW
FLOW, LB/H							
$CaSO_4 \cdot 2H_2O$							
$CaCO_3$							
$CaSO_3 \cdot 1/2H_2O$							
INERTS/DUST							
WATER							
TOTAL, LB/H							
TEMP, DEG F							
DEN, LB/CUFT							
WT% SOLIDS							
pH VALUE							
FLOW, GPM							

SAMPLE

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 wt% S Coal - WES Out of Service

LIQUID STREAMS

STREAM NO. DESCRIPTION	306 WES FLOW	308 WASTE WATER	310 FILTRATE RETURN	311 WASTE WATER	501 LMSTNE FEED	604 CENT WASH	605 MAKE-UP WATER	803 HYD LIME
FLOW, LB/H								
CaSO4*2H2O								
CaCO3								
CaSO3*1/2H2O								
INERTS/DUST								
WATER								
TOTAL, LB/H								
TEMP, DEG F								
DEN, LB/CUFT								
WT% SOLIDS								
pH VALUE								
FLOW, GPM								

SAMPLE

Demonstration Test Plan

Demonstration Test: 3

Coal Description: C

Sulfur Concentration: 3.25 wt%

Gas Analytical Matrix And Sampling Frequency
Samples Per Test Period

Sample Location	Gas Flow, Temperature, Pressure	Gas Comp H2O	Gas Comp O2, CO2	SO2	NOx	SO3	HCL,HF	Fly Ash	Partial Load-Set Samples	Full Load-Set Samples
Scrubber Inlet	F-1x3	F-1x3	F-1x3	F-1x3	F-1x3	F-1x3	F-1x3	F-1x3	2x3	3x3
Scrubber Outlet	F-1x3	F-1x3	F-1x3	F-1x3	F-1x3	F-1x3	F-1x3	F-1x3	2x3	3x3
								Totals	4x3	6x3

F-# =the # of samples

Department of Energy

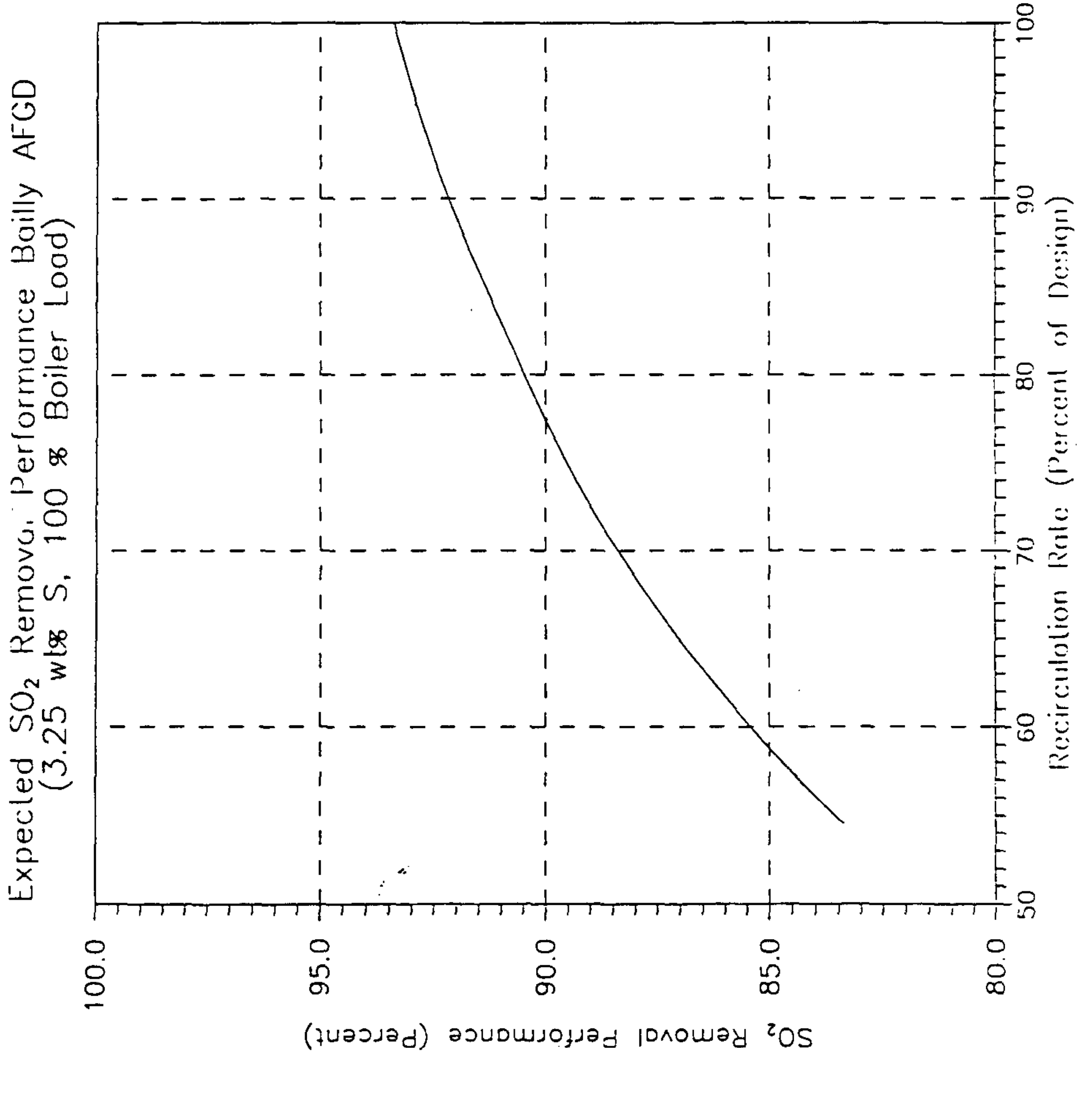
Demonstration Plan

Demonstration Test III

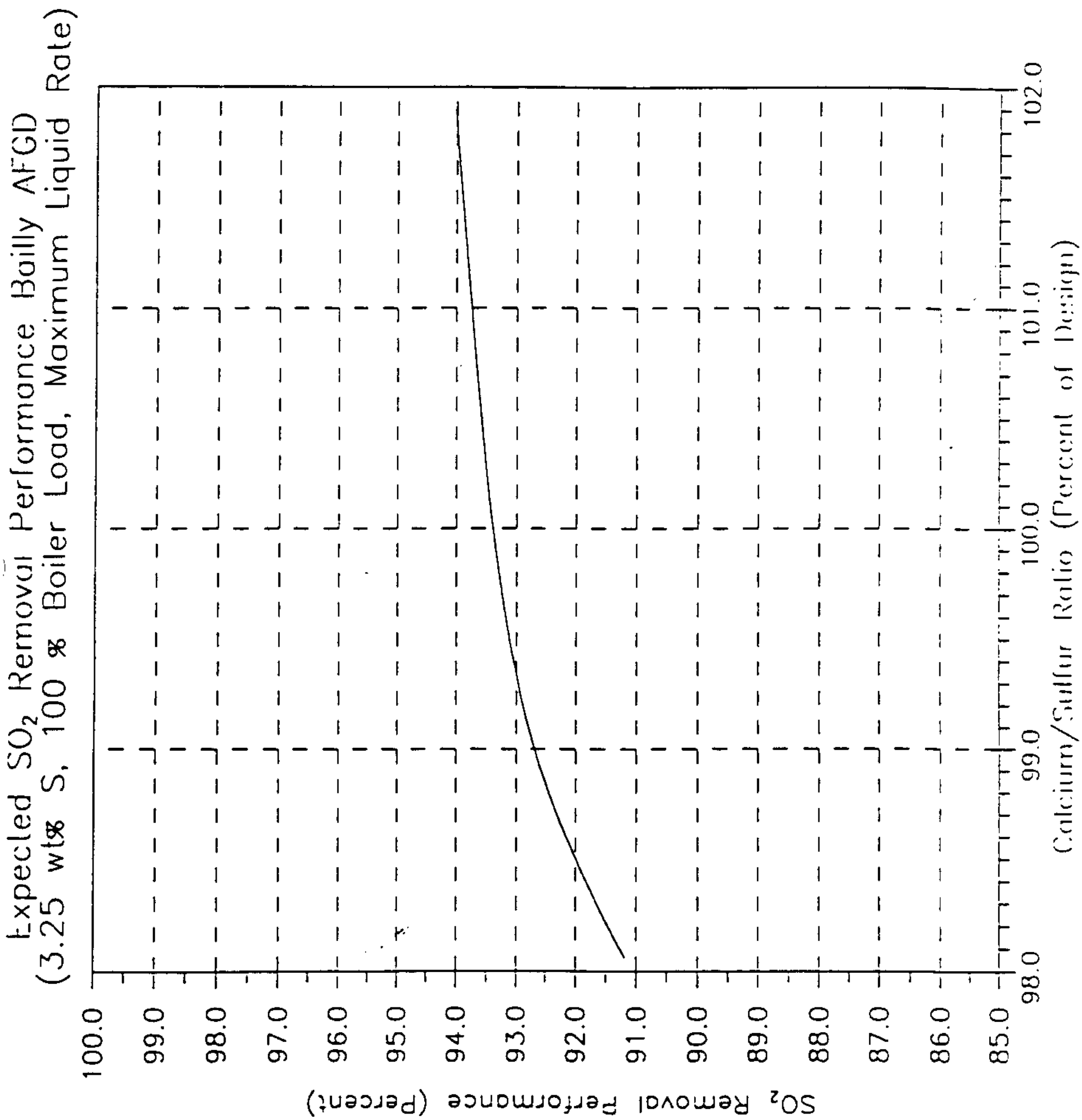
Expected Results

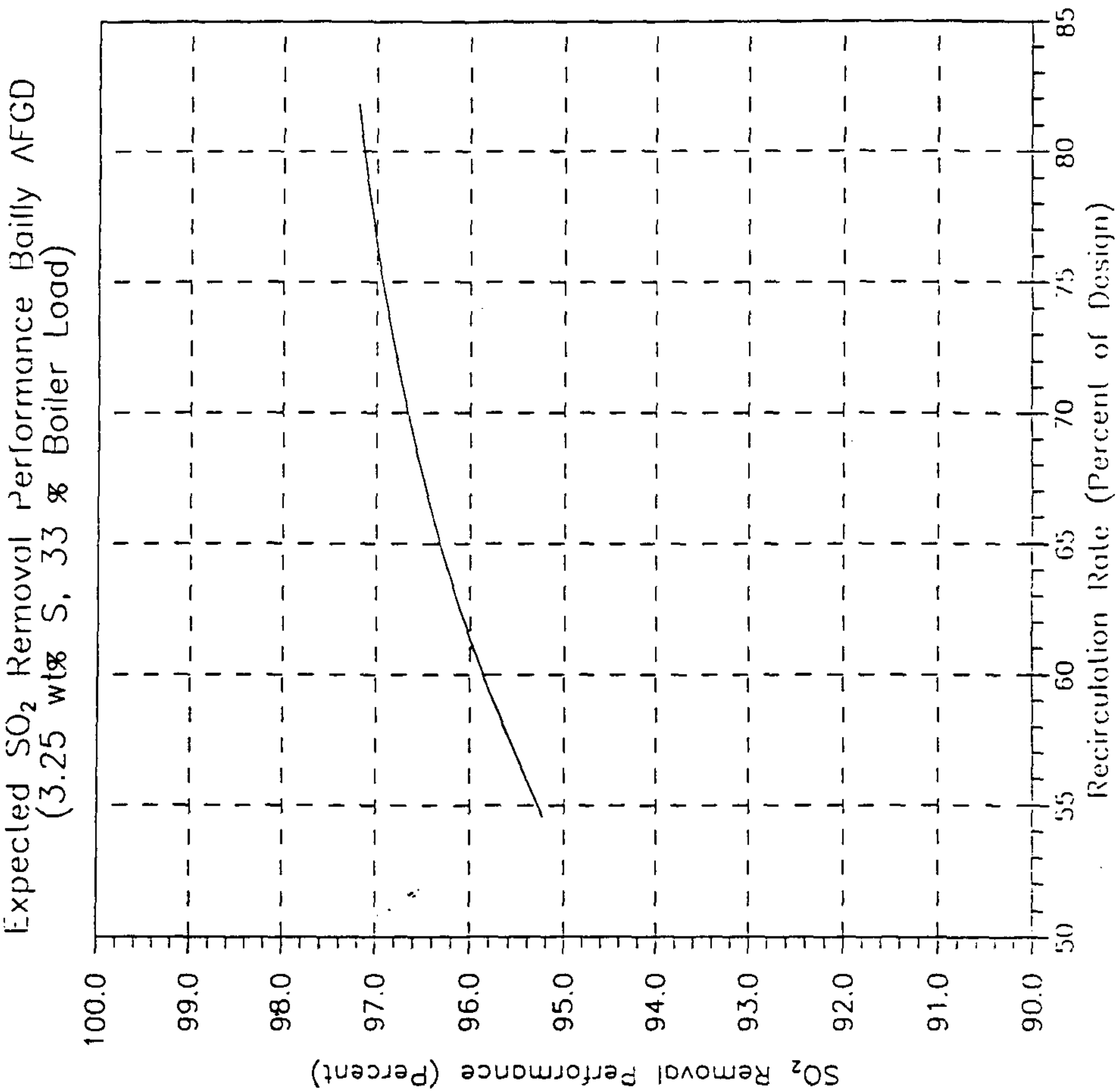
REV NO.	DATE	DESCRIPTION	CHECKED	DATE	APPRVD	DATE

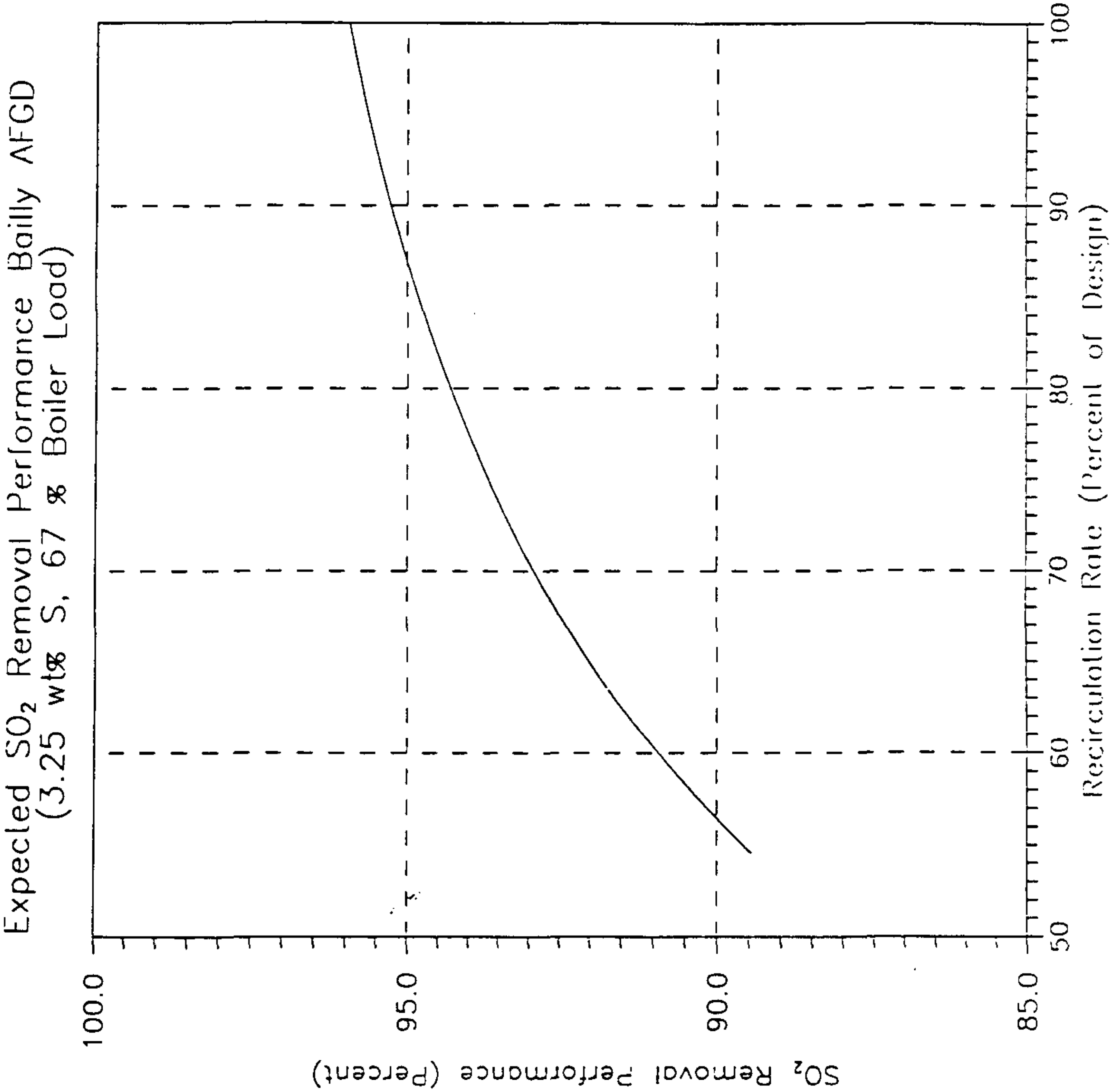
	INITIALS	DATE	
APPRVD			CUSTOMER Northern Indiana
CHECKED			PROJECT **Bailly 600 MW AFGD**
DRAWN	GNB	2/18/91	DRAWING NUMBER: 9-6992-DOE-002-C-R — REVISION: 1
ISSUED			
PURE AIR			FILE — CABINET



Expected SO_2 Removal Performance Bailly AFGD
(3.25 wt% S, 100 % Boiler Load)
100.0
95.0
90.0
85.0
80.0
SO_2 Removal Performance (Percent)
50
60
70
80
90
100
Recirculation Rate (Percent of Design)


Expected SO_2 Removal Performance Bailly AFGD
(3.25 wt% S, 100 % Boiler Load, Maximum Liquid Rate)
SO_2 Removal Performance (Percent)
Calcium/Sulfur Ratio (Percent of Design)
100.0
99.0
98.0
97.0
96.0
95.0
94.0
93.0
92.0
91.0
90.0
89.0
88.0
87.0
86.0
85.0
98.0
99.0
100.0
101.0
102.0


Expected SO_2 Removal Performance Bailly AFGD
(3.25 wt% S, 33 % Boiler Load)
SO_2 Removal Performance (Percent)
100.0
99.0
98.0
97.0
96.0
95.0
94.0
93.0
92.0
91.0
90.0
Recirculation Rate (Percent of Design)
50
55
60
65
70
75
80
85


Expected SO_2 Removal Performance Bailly AFGD
(3.25 wt% S, 67 % Boiler Load)
SO_2 Removal Performance (Percent)
Recirculation Rate (Percent of Design)
100.0
95.0
90.0
85.0
50
60
70
80
90
100

5.0 TEST RESULTS

5.1 DISCUSSION

The overall objectives of DOE Demonstration Test Plan No. III were to evaluate (1) the effect of liquid-to-gas ratio, (2) the effect of calcium utilization, and (3) oxidation on system performance, including SO_2 removal efficiency and by-product gypsum quality.

The coal used for test No. III had a sulfur content of approximately 3.1% and heating value of 10,874 BTU/LB. This is the normal coal being used for Units #7 and #8. Table 1 summarizes the result of ultimate and proximate coal analysis used during the testing.

Demonstration Test Plan No. III called for a total of 29 tests; seventeen (17) tests at 510 MW (gross)(maximum load for Units #7 and #8), seven (7) tests at 340 MW (gross)(67% of maximum combined load or maximum load for Unit #8), and five (5) tests at 170 MW (gross)(33% of maximum combined load or maximum load for Unit #7). Demonstration Test Plan is presented in Tables 2 through 4. The megawatt numbers given in the test plan were net vs. the gross numbers in the results. As indicated above at each load the effect of liquid-to-gas ratio (L/G), calcium-to-sulfur (stoichiometric) ratio and oxidation on system performance will be evaluated.

Demonstration Test No. III started on August 11, 1992 and continued until September 29, 1992. A total of 34 tests were conducted during this period which consisted of 18 tests at full load (Table 5), 11 tests at 67% load (Unit #8 at MCR, Table 6), and five (5) tests at 33% load (Unit #7 at MCR, Table 7).

Results

Liquid-to-Gas (L/G) Ratio

The L/G ratio was fluctuated by varying the number of operating recirculation pumps. At 100% load, the recirculation flow was varied from 60% to 100% of total liquid flow while maintaining a relatively constant stoichiometric ratio of 1.046 (moles of calcium per moles of SO_2 removed). Table 11, Test No.'s one through thirteen, covers the high load period. Power station problems caused some tests to be at lower load (1A, 7, 6R, 10B, 11A, 11B, 13). Since these were L/G tests, the lower megawatt load provided data points that were intermediate to the 66% and 100% loads, and the L/G was calculated accordingly.

As expected, SO_2 removal increases with increasing recirculation flow rate. For example, at 100% load and a stoichiometric ratio of 1.046, SO_2 removal increased from 88.6% to 93.4% by increasing absorber recirculation from 61% to 80% of its design value (Figure 1). It should be pointed out that the actual system performance exceeded the expected design system performance by approximately one percent at full load, 1.5 percent at 67% load (Figure 2) and 2.5 percent at 33% load (Figure 3). The dashed line in Figures 1 through 3 represents the expected design system performance. The rate of recirculation flow tested at 67% load varied from 55% to 75% (Figure 2) achieving 91% to 96% SO_2 removal efficiency at a stoichiometric ratio of 1.02.

At 33% boiler load (Figure 3) SO_2 removal performance was evaluated at approximately 52% to 70% recirculation flow rate while maintaining 1.017 moles of calcium per mole of SO_2 removal in the recirculation slurry. SO_2 removal performance at 33% load was at least 99% at all times.

Stoichiometric Ratio

Stoichiometric ratio (SR) is defined as moles of total calcium (or calcium carbonate) fed to the FGD system per mole of sulfur dioxide removed from the FGD system. Stoichiometric ratio is calculated from the laboratory analysis of absorber slurry by the following equation:

$$SR = \frac{\text{moles Ca}}{\text{moles } SO_4 + \text{moles } SO_3}$$

To evaluate the effect of SR on the system performance, the absorber calcium carbonate level was varied from 35 to 131 mmole/l while maintaining 72% of design recirculation flow at 100 percent boiler load (Figure 4). As illustrated in this figure, the SO_2 removal efficiency increases from about 89% to 93.5% by increasing SR from about 1.02 to 1.08. It should be pointed out that during the 100% stoichiometric ratio testing, the absorber recirculation was limited to 72% of its design value. At 100% of the design recirculation rate, the expected SO_2 removal efficiency would exceed 95 percent at SR of 1.05. Similar to L/G performances, the actual system performance exceeded the expected system performance (dashed line on Figure 4).

The effect of SR on SO_2 removal efficiency was also tested at 67 and 33 percent boiler load. The results of the testing are presented in Figures 5 and 6 respectively. At reduced boiler loads, the absorber recirculation rate was limited to 60% of its design value. The results, however, (as expected) are much better than full boiler load testing.

Oxidation

An important aspect of Bailly's AFGD system is in situ forced oxidation using a patented air rotary sparger (ARS). In addition to the three ARSs, a small section of the absorber tank is filled with two rows of fixed air sparger (FAS) piping to maximize total oxidation during 4.5% sulfur coal demonstration. To demonstrate the capability of the ARS, oxidation air to the FAS was shut off during the oxidation testing at all three boiler loads. Table 8 presents the oxidation test results. As shown in this table, ARS can easily oxidize the absorber slurry even at reduced air flow. Nearly 100% oxidation was achieved in all testing. The oxidation in Table 8 was calculated using the following equation:

$$\underset{\text{(mole \%)}}{\text{Oxidation}} = \left(1 - \frac{SO3}{SO4}\right) \times 100$$

where SO_3 and SO_4 are concentration of calcium sulfite and calcium sulfate in absorber slurry (mmole/l), respectively.

As indicated in Table 8 (at 67% load tests), 100% oxidation is essential for higher SO_2 removal.

Gypsum Quality

A daily gypsum sample was collected during the DOE Demonstration Test No. III. These samples were analyzed for gypsum purity ($CaSO_4 \cdot 2H_2O$), calcium sulfite ($CaSO_3 \cdot 1/2\ H_2O$), calcium carbonate ($CaCO_3$), chloride and other soluble salts.

Table 9 presents the range of the gypsum parameters tested, as well as the average values. Wallboard quality gypsum was produced during the DOE Demonstration Test No. III.

TABLE 1

DEMONSTRATION III

COAL ANALYSIS

ULTIMATE ANALYSIS (AS REC'D)

	WEIGHT %
CARBON	62.10
HYDROGEN	4.09
NITROGEN	1.22
SULFUR	3.12
OXYGEN	8.19
CHLORINE	0.06
MOISTURE	11.14
ASH	10.10

PROXIMATE ANALYSIS (AS REC'D)

	WEIGHT %	
	RANGE	AVERAGE
MOISTURE	11.80 - 15.82	13.20
ASH	9.48 - 13.20	10.80
SULFUR	2.82 - 3.96	3.10
BUT/LB AS RECEIVED	10,215 - 11,143	10,874

TABLE 2

Demonstration Test Plan

(100% Load)

Demonstration Test: III

Coal Description: C

Sulfur Concentration: 3.0-3.5%

		Boiler Conditions			Liquid	Oxidation		Absorber		SO2	Exp.SO2	Expected
TEST NO.	TEST Variable	FGD LOAD (MW)	#7 LOAD (MW)	#8 LOAD (MW)	Recirc. Rate (GPM)	Air Rate (SCFM)	Ca/S Ratio (Mole)	DENSITY (g/l)	Solids Conc %	Inlet Conc lbs/mmbtu	Outlet Conc lbs/mmbtu	Gypsum Purity (%)
1	Ca/S	510	170	340	175,000	15,000	1.03	1.14	25	5.91	<0.6	95
2	Baseline	510	170	340	175,000	15,000	1.03	1.14	25	5.91	<0.6	95
3	Ca/S	510	170	340	175,000	15,000	1.05	1.14	25	5.91	<0.6	95
4	Baseline	510	170	340	175,000	15,000	1.05	1.14	25	5.91	<0.6	94
5	Baseline	510	170	340	175,000	15,000	1.05	1.17	25	5.91	<0.6	94
6	Baseline	510	170	340	175,000	15,000	1.05	1.17	25	5.91	<0.6	94
7	Ca/S	510	170	340	175,000	15,000	1.02	1.17	25	5.91	<0.6	96
8	Ca/S	510	170	340	175,000	15,000	1.07	1.17	25	5.91	<0.6	94
9	Ca/S	510	170	340	175,000	15,000	1.08	1.17	25	5.91	<0.6	93
10	L/G	510	170	340	175,000	15,000	1.05	1.17	25	5.91	<0.6	95
11	L/G	510	170	340	175,000	15,000	1.05	1.17	25	5.91	<0.6	95
12	L/G	510	170	340	188,000	15,000	1.05	1.17	25	5.91	<0.6	95
13	L/G	510	170	340	200,900	15,000	1.05	1.17	25	5.91	<0.6	95
14	L/G	510	170	340	161,100	15,000	1.05	1.17	25	5.91	<0.6	95
15	L/G	510	170	340	144,000	15,000	1.05	1.17	25	5.91	<0.6	95
16	Oxidation	510	170	340	175,000	10,000	1.05	1.17	25	5.91	<0.6	95
17	Oxidation	510	170	340	175,000	8,000	1.05	1.17	25	5.91	<0.6	95

TABLE 3

Demonstration Test Plan

(67% Load)

Demonstration Test: III

Coal Description: C

Sulfur Concentration: 3.0-3.5%

TEST NO.	TEST Variable	Boiler Conditions FGD LOAD (MW)	#7 LOAD (MW)	#8 LOAD (MW)	Liquid Recirc. Rate (GPM)	Oxidation Air Rate (SCFM)	Ca/S Ratio (Mole)	Absorber DENSITY (g/l)	Solids Conc %	SO2 Inlet Conc lbs/mmbtu	Exp.SO2 Outlet Conc lbs/mmbtu	Expected Gypsum Purity (%)
18	Ca/S	340	0	340	144,000	12,000	1.03	1.17	25	5.91	<0.6	96
19	Ca/S	340	0	340	161,000	12000	1.04	1.17	25	5.91	<0.6	95
20	Ca/S	340	0	340	122,000	12000	1.05	1.17	25	5.91	<0.6	94
21	L/G	340	0	340	175,000	12000	1.03	1.17	25	5.91	<0.6	96
22	L/G	340	0	340	144,000	12000	1.03	1.17	25	5.91	<0.6	96
23	Oxidation	340	0	340	144,000	8000	1.03	1.17	25	5.91	<0.6	96
24	Oxidation	340	0	340	144,000	5000	1.03	1.17	25	5.91	<0.6	96

TABLE 4

Demonstration Test Plan

(33% Load)

Demonstration Test: III

Coal Description: C

Sulfur Concentration: 3.0-3.5%

TEST NO.	TEST Variable	Boiler Conditions FGD LOAD (MW)	#7 LOAD (MW)	#8 LOAD (MW)	Liquid Recirc. Rate (GPM)	Oxidation Air Rate (SCFM)	Ca/S Ratio (Mole)	Absorber DENSITY (g/l)	Solids Conc %	SO2 Inlet Conc lbs/mmbtu	Exp.SO2 Outlet Conc lbs/mmbtu	Expected Gypsum Purity (%)
25	L/G	170	0	170	144,000	12,000	1.03	1.17	25	5.91	<0.3	96
26	Ca/S , L/G	170	0	170	122,000	12,000	1.02	1.17	25	5.91	<0.3	97
27	L/G	170	0	170	161,000	12,000	1.03	1.17	25	5.91	<0.3	96
28	Ca/S , Oxid	170	0	170	122,000	7,000	1.02	1.17	25	5.91	<0.3	97.0
29	Oxidation	170	0	170	122,000	5,000	1.02	1.17	25	5.91	<0.3	97.0

Table 5

Demonstration Test Results

Demonstration Test: III

Coal Description: Captain

Sulfur Concentration: 3.0-3.5

ES NO.	DATE	Boiler Condition FGD LOAD (MW)	#7 LOAD (MW)	#8 LOAD (MW)	LIQUID Recirc. RATE (gpm)	FAS Air Rate (SCFM)	ARS Air Rate (SCFM)	Absorber DENSITY (g/l)	Solids Conc (%)	Ca/S RATIO (Mole)	SO2 Inlet Conc (lbs/mmbtu)	SO2 OUT Conc (lbs/mmbtu)	SO2 Removal Efficiency (%)
1	Tue 11-Aug-92	514	175	339	163,600	8000	6996	1.14	19.2	1.035	5.03	0.40	92.2
1A	Wed 12-Aug-92	492	171	321	163,600	7998	7004	1.15	21.2	1.035	5.16	0.38	92.7
2	Thu 13-Aug-92	519	175	344	163,600	8002	6999	1.16	21.4	1.041	5.27	0.37	92.9
6	Mon 17-Aug-92	518	170	348	171,900	8010	6994	1.19	25.7	1.043	5.71	0.23	96.0
3	Tue 18-Aug-92	523	175	348	171,900	7991	6998	1.18	25.3	1.019	5.62	0.61	89.2
4	Thr 27-Aug-92	515	175	340	171,900	6995	7007	1.18	25.8	1.068	5.69	0.40	92.9
5	Fri 28-Aug-92	517.6	178	340	171,900	7983	6998	1.18	24.9	1.081	5.61	0.37	93.5
7	Tue 1-Sep-92	501	158	343	145,900	6999	7004	1.18	24.8	1.044	5.58	0.37	93.3
8	Wed 2-Sep-92	509.6	166	344	158,200	7000	6995	1.18	24.4	1.046	5.54	0.53	90.4
9	Thu 3-Sep-92	519.54	172	348	181,850	8006	6997	1.19	26.2	1.043	5.56	0.41	92.6
7R	Fri 4-Sep-92	518.14	171	347	145,900	7005	6995	1.17	23.7	1.050	5.64	0.64	88.6
6R	Mon 21-Sep-92	482.8	175	308	171,900	6994	8000	1.17	24.3	1.046	5.49	0.50	90.9
10A	Tue 22-Sep-92	519	175	344	190,400	8000	8265	1.18	25.4	1.046	5.47	0.36	93.4
10B	Tue 22-Sep-92	404.3	132	273	190,400	8000	8500	1.18	25.4	1.047	5.42	0.23	95.8
11A	Wed 23-Sep-92	389.2	112	277	171,900	8000	8500	1.17	23.5	1.082	5.32	0.24	95.6
11B	Thu 24-Sep-92	475.4	135	341	171,900	8000	7000	1.18	24.4	1.079	5.30	0.35	93.3
12	Fri 25-Sep-92	516.8	175	342	171,900	0	7010	1.18	24.5	1.047	5.32	0.52	90.3
13	Tue 29-Sep-92	494.2	172	323	171,900	0	6994	1.18	25.2	1.044	5.42	0.51	90.6

Table 6

Demonstration Test Results

Demonstration Test: III

Coal Description: Captain

Sulfur Concentration: 3.0-3.5

ES	DATE	Boiler Condition			LIQUID	FAS	ARS	Absorber			SO2	SO2	SO2
		FGD	#7	#8	Recirc.	Air	Air		Solids	Ca/S	Inlet	OUT	Removal
NO.		LOAD	LOAD	LOAD	RATE	Rate	Rate	DENSITY	Conc	RATIO	Conc	Conc	Efficiency
		(MW)	(MW)	(MW)	(gpm)	(SCFM)	(SCFM)	(g/l)	(%)	(Mole)	(lbs/mmbtu)	(lbs/mmbtu)	(%)
14	Tue 8-Sep-92	344.7	0	345	145,900	5000	5000	1.17	24.0	1.050	5.69	0.17	97.1
15	Wed 9-Sep-92	346.3	0	346	145,900	5000	5000	1.18	25.1	1.018	5.59	0.39	93.0
16	Thu 10-Sep-92	346.5	0	347	145,900	5000	5000	1.18	25.1	1.030	5.56	0.30	94.6
14R	Fri 11-Sep-92	343	0	343	145,900	5000	5000	1.18	25.4	1.048	5.49	0.26	95.2
17A	Mon 14-Sep-92	342	0	342	158,200	5000	5000	1.18	25.8	1.017	5.72	0.36	93.7
18	Tue 15-Sep-92	344.6	0	345	171,900	5000	5000	1.18	25.4	1.018	5.85	0.31	94.7
19	Wed 16-Sep-92	348	0	348	181,850	5000	5000	1.14	19.1	1.022	5.40	0.26	95.2
20	Thu 17-Sep-92	346.8	0	347	158,200	4885	0	1.19	26.3	1.015	5.63	0.47	91.7
21A	Fri 18-Sep-92	346.7	0	347	158,200	0	2050	1.17	23.2	1.019	5.68	0.91	84.0
21B	Fri 18-Sep-92	347.7	0	348	158,200	0	2540	1.17	23.2	1.020	5.68	0.78	86.3
21C	Fri 18-Sep-92	348.8	0	349	158,200	0	3100	1.17	23.2	1.018	5.68	0.43	92.4

Table 7

Demonstration Test Results

Demonstration Test: III

Coal Description: Captain

Sulfur Concentration: 3.0-3.5

ES NO.	DATE	Boiler Condition FGD LOAD (MW)	#7 LOAD (MW)	#8 LOAD (MW)	LIQUID Recirc. RATE (gpm)	FAS Air Rate (SCFM)	ARS Air Rate (SCFM)	Absorber DENSITY (g/l)	Solids Conc (%)	Ca/S RATIO (Mole)	SO2 Inlet Conc (lbs/mmbtu)	SO2 OUT Conc (lbs/mmbtu)	SO2 Removal Efficiency (%)
23	Sat 22-Aug-92	171	171	0	145,200	5600	5600	1.17	24.4	1.029	5.31	0.02	99.7
24	Sun 23-Aug-92	173	173	0	145,200	5614	5610	1.17	25.0	1.017	5.28	0.03	99.4
25	Mon 24-Aug-92	173	173	0	128,300	5600	5600	1.18	25.3	1.016	5.66	0.07	98.8
26	Tue 25-Aug-92	174	174	0	128,300	293	5657	1.18	25.5	1.016	5.67	0.05	99.1
27	Wed 26-Aug-92	176	176	0	128,300	0	2600	1.18	25.3	1.017	5.29	0.04	99.3

TABLE 8
DEMONSTRATION III
Oxidation Results

TEST NO. (#)	BOILER LOAD (%)	RECIRCULATION PUMPS (#)	STOICHIOMETRIC RATIO (Ca : S)	OXIDATION AIR FLOW FAS (SCFM)	OXIDATION AIR FLOW ARS (SCFM)	SO_2 REMOVAL EFFICIENCY (%)	OXIDATION (MOLE %)
6R	100	9	1.046	700	8000	90.9	99.98
12	100	9	1.046	0	7000	90.3	99.98
17A	67	8	1.017	5000	5000	93.7	99.98
21A	67	8	1.019	0	2050	84.0	99.50
21B	67	8	1.020	0	2540	86.3	99.70
21C	67	8	1.018	0	3100	92.4	99.91
25	33	6	1.016	5600	5600	98.8	99.97
26	33	6	1.016	293	5667	99.1	99.94
27	33	6	1.017	0	2600	99.3	99.97

TABLE 9

DEMONSTRATION III

GYPSUM ANALYSIS

	RANGE	AVERAGE
GYPSUM ($CaSO_4 \cdot 2H_2O$, %)	93.5 - 97.3	95.2
CALCIUM CARBONATE ($CaCO_3$, %)	0.4 - 4.5	2.7
CHLORIDE (Cl, PPM)	9 - 148	39
MAGNESIUM OXIDE (MgO, %)	0.8 - 0.51	0.23
SILICON OXIDE (SiO_2, %)	0.27 - 0.64	0.38
FERRIC OXIDE (Fe_2O_3, %)	0.15 - 0.31	0.2
FREE MOISTURE (%)	4.2 - 8.8	8.5

TABLE 10

DEMONSTRATION III

FLUE GAS ANALYSIS

UNIT #7 LOAD (MW)	175	0	175
UNIT #8 LOAD (MW)	345	345	0
TOTAL LOAD (%)	100	67	33
AFGD FLUE GAS CONDITION			
ACFMW	2,100,000	1,267,000	790,000
SCFMW	1,285,000	846,000	500,000
TEMP. (°F)	325	330	295
MOISTURE (% VOL.)	8.0	7.6	7.5
SULFUR DIOXIDE (PPMD)	2,230	2,300	2,100
HYDROCHLORIC ACID (PPM)	40	50	70
PARTICULATE (LBS./MMBTU)	0.060	0.075	0.050

Demonstration Test Results - Table 11

Demonstration Test: III

Coal Description: C

Sulfur Concentration: 3.0-3.5 %

TEST NO.	DATE		Boiler Conditions FGD LOAD (MW)	#7 LOAD (MW)	#8 LOAD (MW)	L/G	LIQUID RATE (gpm)	NO. PUMPS UPPER II	NO. PUMPS LOWER II	FAS Air Rate (SCFM)	ARS Air Rate (SCFM)	DENSITY	Absorber Solids Conc %	CHLORIDE PPM	SO4 Conc. mmol/l	CO3 Conc. mmol/l	CA/S RATIO	SO2 Inlet Conc lbs/mmbtu	SO2 OUT Conc lbs/mmbtu	SO2 Removal Efficiency %	NO. LIQ SAMP
1	Tue 11-Aug-92	Ca/S	314	175	339	91	163,600	4	5	8000	6996	1.14	19.2	11264	1275	44	1.035	5.03	0.40	92.2	14
1A	Wed 12-Aug-92	Ca/S	492	171	321	95	163,600	4	5	7998	7004	1.15	21.2	12653	1343	47	1.035	5.16	0.38	92.7	REO
2	Thu 13-Aug-92	Ca/S	319	175	344	91	163,600	4	5	8002	6999	1.16	21.4	11070	1496	62	1.041	5.27	0.37	92.9	14
6	Mon 17-Aug-92	L/G	318	170	348	95	171,900	4	5	8010	6994	1.19	25.7	10070	1694	74	1.043	5.71	0.23	96.0	14
3	Tue 18-Aug-92	Ca/S	323	175	348	93	171,900	4	5	7991	6998	1.18	25.3	10415	1798	35	1.019	5.62	0.61	89.2	14
4	Thr 27-Aug-92	Ca/S	315	175	340	95	171,900	4	5	6995	7007	1.18	25.8	6700	1680	113	1.068	5.69	0.40	92.9	14
5	Fri 28-Aug-92	Ca/s	317.6	178	340	95	171,900	4	5	7983	6998	1.18	24.9	6489	1617	131	1.081	5.61	0.37	93.5	14
7	Tue 1-Sep-92	L/G	301	158	343	84	145,900	3	4	6999	7004	1.18	24.8	6530	1687	75	1.044	5.58	0.37	93.3	14
8	Wed 2-Sep-92	L/G	509.6	166	344	89	158,200	4	4	7000	6995	1.18	24.4	6327	1647	76	1.046	5.54	0.53	90.4	14
9	Thu 3-Sep-92	L/G	519.54	172	348	100	181,850	4	6	8006	6997	1.19	26.2	7178	1802	78	1.043	5.56	0.41	92.6	14
7R	Fri 4-Sep-92	L/G	518.14	171	347	80	145,900	3	4	7005	6995	1.17	23.7	7506	1589	79	1.050	5.64	0.64	88.6	14
6R	Mon 21-Sep-92	L/G	482.8	175	308	104	171,900	4	5	6994	8000	1.17	24.3	8037	1635	75	1.046	5.49	0.50	90.9	14
10A	Tue 22-Sep-92	L/G	319	175	344	104	190,400	5	6	8000	8265	1.18	25.4	7462	1708	78	1.046	5.47	0.36	93.4	14
10B	Tue 22-Sep-92	L/G	404.3	132	273	143	190,400	5	6	8000	8500	1.18	25.4	7462	1664	79	1.047	5.42	0.23	95.8	14
11A	Wed 23-Sep-92	L/G	389.2	112	277	135	171,900	4	5	8000	8500	1.17	23.5	7592	1553	128	1.082	5.32	0.24	95.6	14
11B	Thu 24-Sep-92	L/G	475.4	135	341	106	171,900	4	5	8000	7000	1.18	24.4	7721	1628	129	1.079	5.30	0.35	93.3	14
12	Fri 25-Sep-92	Oxid	516.8	175	342	95	171,900	4	5	0	7010	1.18	24.5	7575	1658	78	1.047	5.32	0.52	90.3	REO
13	Tue 29-Sep-92	Oxid	494.2	172	323	101	171,900	4	5	0	6994	1.18	25.2	6643	1683	74	1.044	5.42	0.51	90.6	14
14	Tue 8-Sep-92	Ca/s	344.7	0	345	131	145,900	3	4	5000	5000	1.17	24.0	7906	1584	79	1.050	5.69	0.17	97.1	14
15	Wed 9-Sep-92	Ca/s	346.3	0	346	130	145,900	3	4	5000	5000	1.18	25.1	7384	1710	30	1.018	5.59	0.39	93.0	14
16	Thu 10-Sep-92	Ca/s	346.5	0	347	130	145,900	3	4	5000	5000	1.18	25.1	6825	1636	49	1.030	5.56	0.30	94.6	14
14R	Fri 11-Sep-92	Ca/s	343	0	343	132	145,900	3	4	5000	5000	1.18	25.4	7428	1670	79	1.048	5.49	0.26	95.2	REO
17A	Mon 14-Sep-92	L/G	342	0	342	143	158,200	4	4	5000	5000	1.18	25.8	7617	1726	29	1.017	5.72	0.36	93.7	REO
18	Tue 15-Sep-92	L/G	344.6	0	345	154	171,900	4	5	5000	5000	1.18	25.4	7642	1731	32	1.018	5.85	0.31	94.7	14
19	Wed 16-Sep-92	L/G	348	0	348	165	181,850	4	6	5000	5000	1.14	19.1	7290	1344	30	1.022	5.40	0.26	95.2	11
20	Thu 17-Sep-92	Oxid	346.8	0	347	141	158,200	4	4	4885	0	1.19	26.3	7686	1806	28	1.015	5.63	0.47	91.7	11
21A	Fri 18-Sep-92	Oxid	346.7	0	347	141	158,200	4	4	0	2050	1.17	23.2	7507	1560	29	1.019	5.68	0.91	84.0	11
21B	Fri 18-Sep-92	Oxid	347.7	0	348	141	158,200	4	4	0	2540	1.17	23.2	7507	1560	31	1.020	5.68	0.78	86.3	11
21C	Fri 18-Sep-92	Oxid	348.8	0	349	140	158,200	4	4	0	3100	1.17	23.2	7507	1560	28	1.018	5.68	0.43	92.4	REO
23	Sat 22-Aug-92	L/G	171	171	0	216	145,200	3	4	5600	5600	1.17	24.4	8052	1662	48	1.029	5.31	0.02	99.7	14
24	Sun 23-Aug-92	L/G	173	173	0	215	145,200	3	4	5614	5610	1.17	25.0	7753	1673	28	1.017	5.28	0.03	99.4	14
25	Mon 24-Aug-92	L/G	173	173	0	190	128,300	3	3	5600	5600	1.18	25.3	7066	1706	28	1.016	5.66	0.07	98.8	14
26	Tue 25-Aug-92	Oxid	174	174	0	189	128,300	3	3	293	5657	1.18	25.5	6734	1708	27	1.016	5.67	0.05	99.1	14
27	Wed 26-Aug-92	Oxid	176	176	0	188	128,300	3	3	0	2600	1.18	25.3	7556	1748	29	1.017	5.29	0.04	99.3	14

FIGURE 1

SO2 REMOVAL PERFORMANCE AT BAILLY AFGD
(100 PERCENT BOILER LOAD)

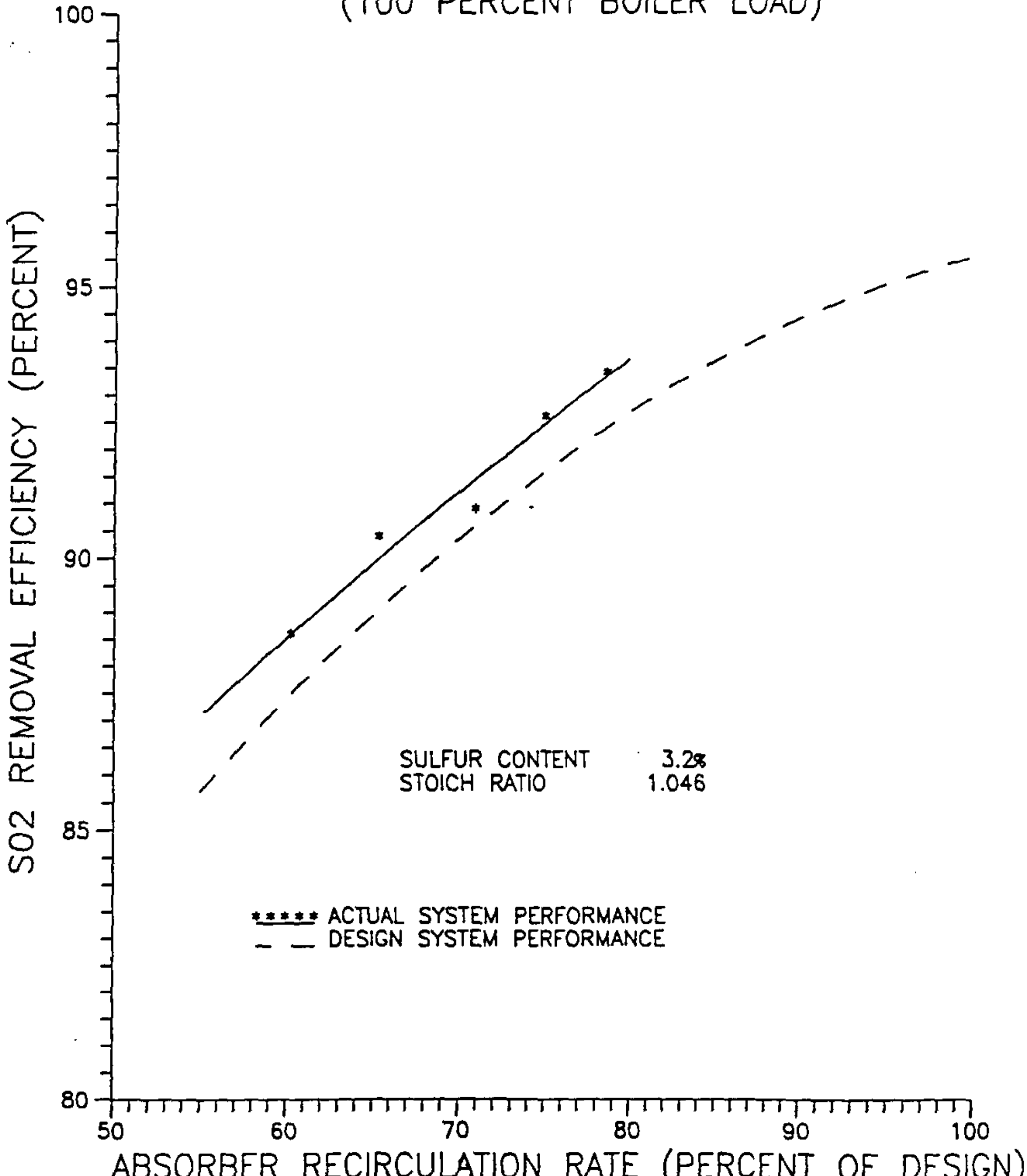


FIGURE 2

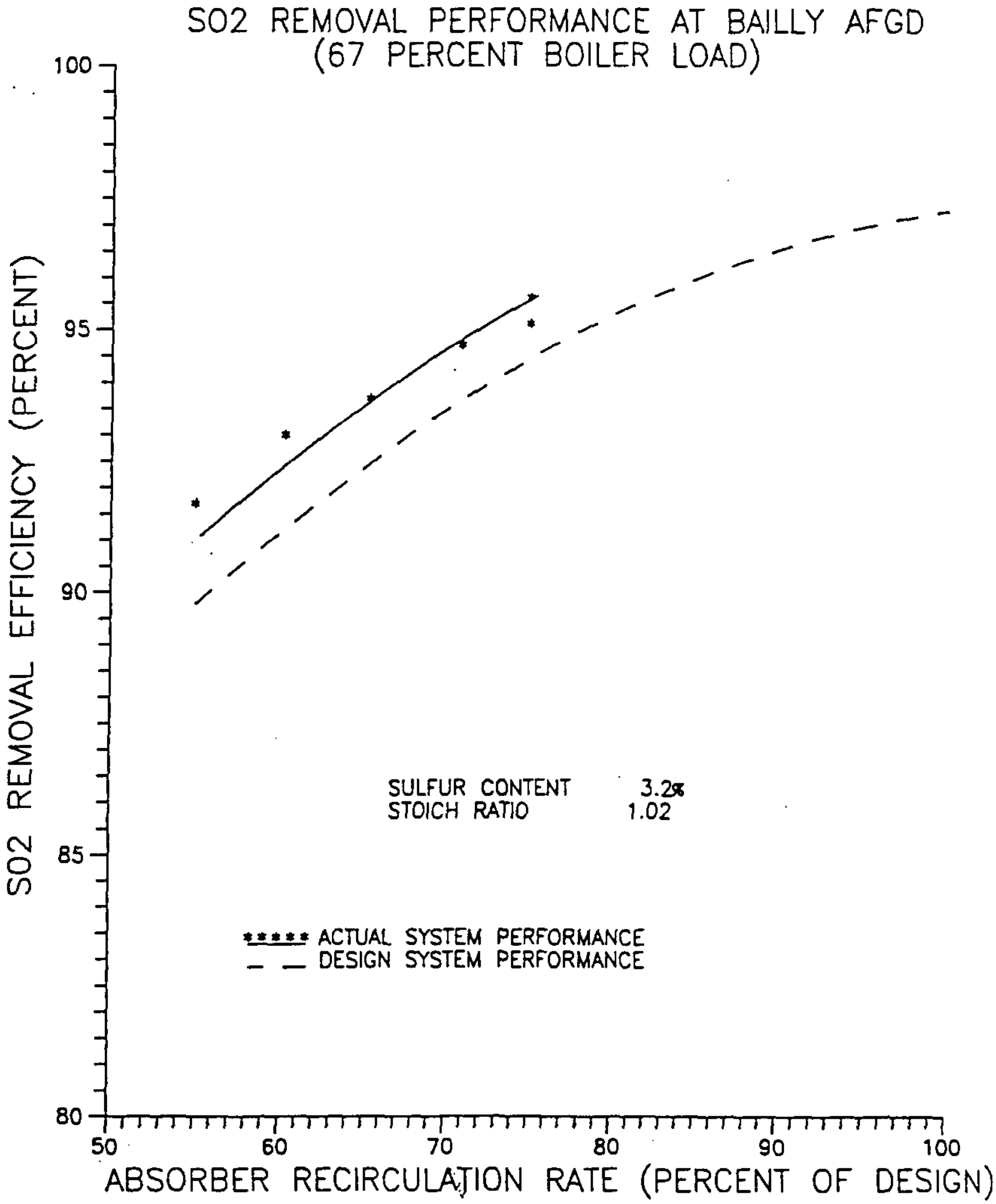

SO2 REMOVAL PERFORMANCE AT BAILLY AFGD
(67 PERCENT BOILER LOAD)
SO2 REMOVAL EFFICIENCY (PERCENT)
100
95
90
85
80
50
60
70
80
90
100
ABSORBER RECIRCULATION RATE (PERCENT OF DESIGN)
SULFUR CONTENT 3.2%
STOICH RATIO 1.02
***** ACTUAL SYSTEM PERFORMANCE
— — DESIGN SYSTEM PERFORMANCE

FIGURE 3

SO2 REMOVAL PERFORMANCE AT BAILLY AFGD
(33 PERCENT BOILER LOAD)

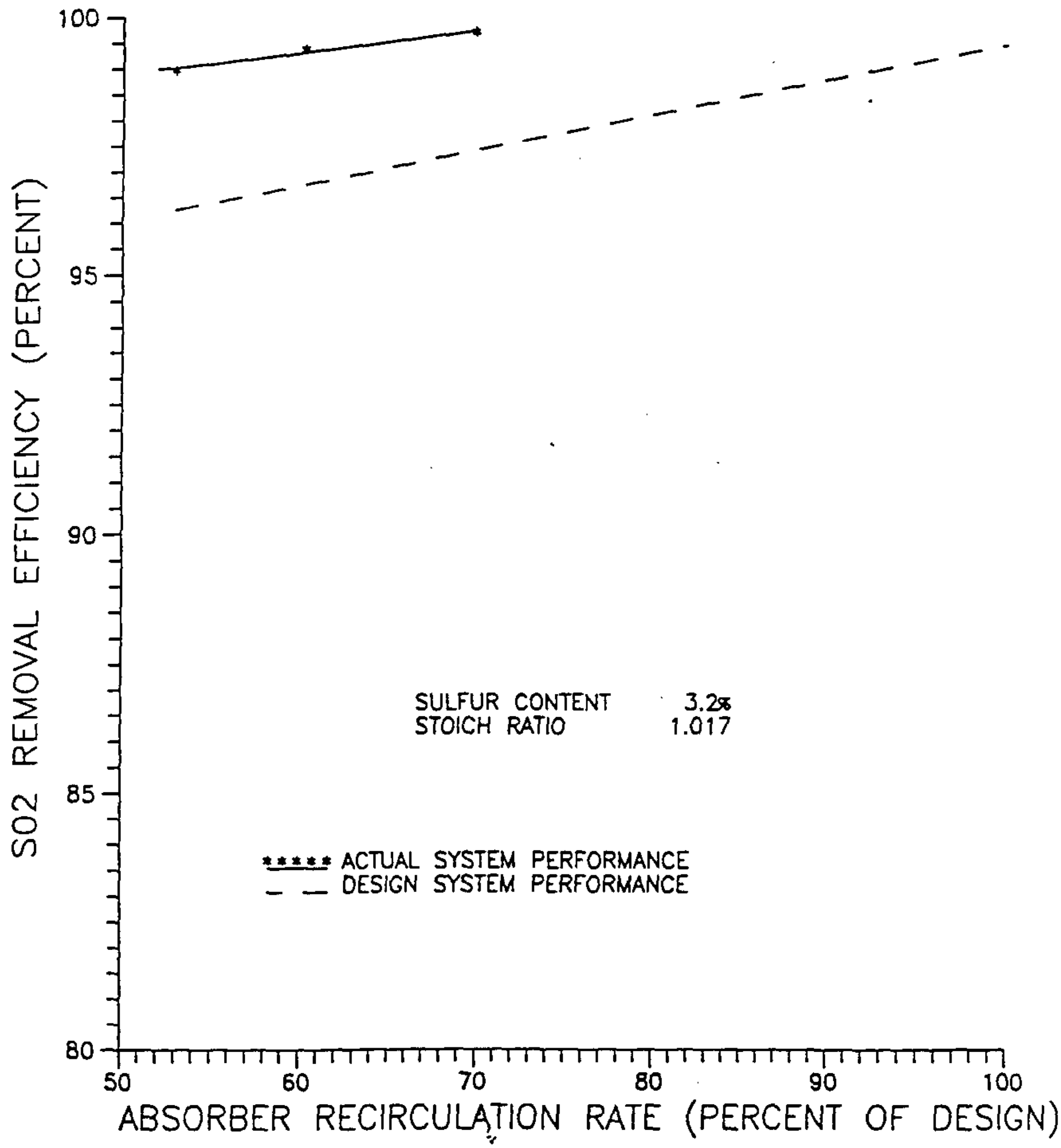
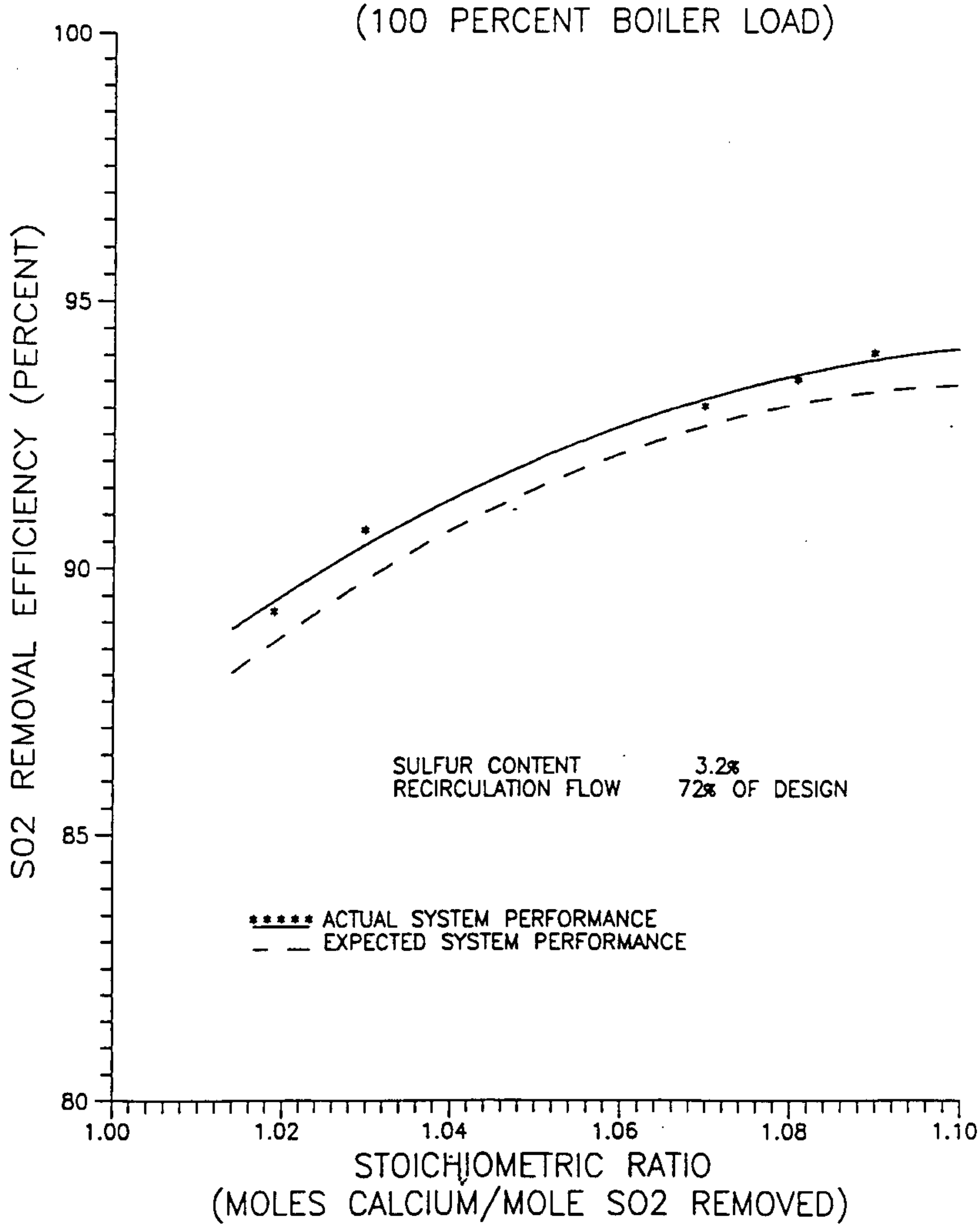


FIGURE 4

SO2 REMOVAL PERFORMANCE AT BAILLY AFGD
(100 PERCENT BOILER LOAD)



SECTION 6.2.2

ANALYTICAL METHODOLOGY

A description of the analytical techniques used to characterize the FGD process streams as outlined in the DOE Demonstration Test and Environmental Monitoring Plan (EMP) documents are included in this section.

The first portion of this section provides information on instrumental techniques used in the analytical characterization process. The second part identifies the analytical parameters which were evaluated in each of the process streams. Referenced analytical procedures and method summaries are provided, where applicable. A listing of reference sources which can be consulted to obtain detailed information on specific analytical procedures used in the evaluation process is provided at the end of the section.

Instrumental Procedures

This section provides a description of the types of major analytical instrumentation and sample preparation procedures used to characterize the raw materials, intermediates, and by-products from the Bailly FGD facility. Many of the method summaries found in the section on analytical methodology will reference these types of instrumental techniques.

X-ray Fluorescence (XRF)

X-ray fluorescence spectrometry[13] is a method used to determine the presence and concentration of chemical elements in solid samples. XRF can quantify most chemical elements in the range of 100 parts per million (ppm) to 100 wt.%. Accuracy is limited only by the calibration samples available and the software used to calculate results. XRF can also be used as a rapid cost-effective approach for scanning the sample to determine the presence of elements other than those of primary interest.

The basis of x-ray fluorescence is the relationship between the wavelength or energy of the x-ray photons emitted by the sample element and the atomic number. When an atom is bombarded with x-ray photons, an inner-orbital electron may be displaced leaving the atom in an excited state. The intensity of the emitted radiation is proportional to the concentration of the emitted element.

An X-ray spectrometer consists of three basic components: a primary source unit, spectrometer, and a detector. The primary source unit consists of a sealed X-ray tube and a stable high voltage generator. This X-ray tube delivers an intense source of radiation on the sample. A portion of the characteristic radiation generated is collected by the spectrometer and processed by the detection system.

Solid samples can be presented to the instrument in one of three ways: as-is, pressed powders, or fused discs. The fusion method provides the highest accuracy for a wide range of materials and is typically the method of choice.

Samples for the fusion process are appropriately dried, ground and homogenized, then passed through a sieve. The sample is placed in a crucible and ignited in a furnace at 950 °C. Lithium tetraborate, a fluxing agent, is added to the sample and the crucible is heated on a Claisse Fluxer for a period of time. The molten specimen is casted into a mold and allowed to solidify into a glass disc. The disc is then polished with a fine abrasive prior to analysis.

X-ray Diffraction (XRD)

Crystals in a sample act as a diffraction grating for X-rays due to the similarity of X-ray wavelengths used and distances between atomic planes in the crystals. Diffracted X-rays create a "pattern" unique to each crystal structure. The intensity of this pattern is proportional to the concentration of the crystal structure from which it originates.

XRD phase analysis[13] of fly ash and gypsum samples was carried out using a Philips PW 1720 diffractometer (CuK α) equipped with θ-compensating slit, graphite monochromator, gas proportional counter detector, pulse height selector, and a strip chart recorder.

The fly ash sample was processed to a fine powder (< 45 μm), packed in an Al sample holder and scanned from 65° to 5° 2θ at 1° 2θ per minute. Once the crystalline phase of interest had been detected, its strongest diffraction peak intensity was measured against that of α–quartz, a phase commonly present in fly ash. Then another mounting was prepared where 1% standard addition of that particular phase, using reagent grade material, was added and thoroughly blended with the fly ash. From the measured relative peak intensities at 0% and 1% standard addition, a straight line was drawn, and the amount of the phase of interest present in the fly ash was obtained by extrapolation.

In determining the limit of delectability of the phase of interest in the fly ash, incremental additions of reagent grade material were made to the fly ash until the strongest diffraction peak of that phase was detected.

Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES)

This instrumental technique allows for the simultaneous or sequential multielement determination of trace elements in solution. The basis of the method is the measurement of atomic emission by spectroscopic techniques. Samples are transported into the instrument as a liquid and converted to an aerosol through a nebulization process. The aerosol produced is transported into the center of a high temperature argon plasma torch where excitation and/or ionization occurs. The excited atoms and ions emit their characteristic radiation which is collected by transfer optics. Emission spectra are dispersed via a grating spectrometer and the intensities of the lines are monitored by photomultiplier tubes (PMT). Background correction is utilized to compensate for variable background contribution to the determination of trace elements. The electrical current measured at the anode of the PMT is converted into voltage which in turn is converted into a digital signal which can be used by computers for further processing.

Flame Atomic Absorption Spectroscopy (FAAS)

Metals in solution cab be quantitatively determined by atomic absorption spectroscopy (AAS). In AAS, a sample is aspirated through a nebulizer and atomized in a flame. An atom cloud is produced by supplying enough thermal energy to a sample to dissociate the chemical compounds into free atoms. Under the proper flame conditions, most of the atoms will remain in the ground state form. A light beam from a hallow cathode lamp is directed through the flame into a monochromator and then onto a detector which measures the amount of light absorbed. Absorption depends upon the presence of free unexcited ground state atoms in the flame. Since the wavelength of the light beam is characteristic of only the metal being determined, the light energy absorbed by the flame is a measure of the concentration of that metal in the sample. Beer's Law states that absorbance is directly proportional to the concentration of an absorbing species.

Graphite Furnace Atomic Absorption Spectroscopy (GFAAS)

The extreme sensitivity of graphite furnace analysis makes this instrument a technique of choice for applications where ultra-trace analysis is desired. Since graphite furnace requires only microliters of sample, this technique can be used when a limited quantity of sample is available.

The graphite furnace is a flameless sampling device. The energy required for atomization is supplied by passing a high electric current through a graphite tube into which the sample has been placed. The furnace sample area is aligned with a spectrophotometer and a light beam from a spectral lamp. The atomic vapor generated from a sample absorbs light from the lamp.

The basic difference between FAAS and GFAAS is the absorption response. In graphite furnace, the sample introduced into the graphite tube is totally consumed in a few seconds. This yields a transient peak-shaped absorption signal. The absorption signal for FAAS is steady state. In GFAAS, light absorption depends on the amount of analyte contained in the aliquot of sample injected into the graphite tube. The absorption peak height will indicate the amount of analyte present in the furnace which can be used to quantify the concentration present in the sample.

Particle Size Distribution - SediGraph® 5000E

The SediGraph® Particle Size Analyzer measures[13] the sedimentation rates, according to Stokes' law, of particles dispersed in a liquid and automatically plots this data as cumulative percent versus equivalent spherical diameter. The instrument uses a finely collimated beam of X-rays to measure the concentration of particles.

Prior to analyzing[13] gypsum or limestone samples, the samples are first dried then sieved to pass a No. 140 mesh sieve. Sample preparation for analysis involves dispersion of the powder in a Sedisperse liquid. Approximately 0.45 g of sample is dispersed ultrasonically in 25 ml of Sedisperse A12 liquid. The ultrasonic bath provides energy for dispersion of particles and also helps warm up the sample to the run temperature.

To perform the actual analysis, the operator calculates a rate, which is a function of the sample .density and the viscosity and density of the liquid. Sample dispersion is placed in the cell compartment, and then is circulated though the cell and the recorder is adjusted to 100% concentration. Actuation of the "RUN" switch stops the pump and starts an automatic programmed analysis. Analysis of gypsum and limestone starts at 100µm and ends at 0.36µm.

Thermogravimetric Analyzer (TGA)

Thermogravimetric analysis[13] is performed using a LECO TGA-500. Gypsum samples undergoing thermogravimetric analysis are prepared by passing the wet sample through a #10 sieve. Dry grade air at a rate of 2 liters per minute begins to flow while the program ramps at a rate of 4°C per minute to a temperature of 45°C and remains until the samples have achieved a constant weight with a deviation of 0.05%. The result is the free water in the gypsum. The samples are then ramped at a rate of 10°C / min. to a temperature of 230°C and remains until constant weight is achieved with a 0.05 % deviation. This result yields the combined water of the gypsum and can be used to calculate the percent gypsum per ASTM C 471. The temperature then increases to 550°C at a rate of 99°C / minute and remains until constant weight is achieved with a 0.05 % deviation. The fourth step of the TGA program ramps to 950 °C at a rate of 99°C / min. and remains until constant weight is achieved with a deviation of 0.05 %. The difference between 550°C and 950 °C yields % CO_2 which can be expressed as carbonate.

GYPSUM BY-PRODUCT ANALYTICAL PROCEDURES

This section provides information on analytical procedures used to characterize by-product gypsum from the FGD operation. The section is comprised of five elements which include general metals analyses, gypsum wallboard manufacturer specifications, particle size distribution, hazardous waste classification, and radioactivity.

Acid Digestion for Metals Analysis

The digestion procedure for metals analyses of gypsum related materials was performed using a modification of ASTM C 471-87 (9)[2]. This procedure was used to prepare samples for analysis by atomic absorption spectroscopy. Certain exceptions to the above method did apply and modifications were carried out as required. An example would be the analysis of silver where HCl cannot be used in the digestion process.

A sample of 0.5 to 1.0 grams was added to a 25 ml of HCL (1:5) and heated with mixing for 15 minutes. Evaporation to dryness steps in the ASTM procedure were eliminated. The solution was further heated for 10 minutes after the addition of 50 ml of hot water. The solution was cooled and transferred to a 100 ml volumetric flask. Concentrated nitric acid (2 ml.) was added to the vessel and made to volume with deionized water.

GENERAL METALS ANALYSIS

The analytical methodology summarized in the general metals section provides a brief description of the techniques used for major, minor, and trace elemental characterization of gypsum manufactured at the Bailly FGD facility.

Table 2-1. Methods for General Metals Analyses of Gypsum

Parameter	Reference Method	Summary
Aluminum	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Antimony	EPA SW-846 Method 7041[3]	Graphite furnace analysis at 217.6 nm with deuterium background correction. Ammonium nitrate was used as a chemical modifier.
Arsenic	EPA SW-846 Method 7060[3]	Modified graphite furnace analysis at 193.7 nm with deuterium background correction. Palladium in citric acid was used as a modifier.
Barium	EPA SW-846 Method 7080[3]	Flame atomic absorption analysis at 553.6 nm with a nitrous oxide-acetylene fuel rich flame. Potassium chloride was used as an ionization suppressant.
Beryllium	EPA SW-846 Method 7091[3]	Graphite furnace analysis at 234.9 nm with deuterium background correction.
Boron	CTL Method[13]	Calorimetric method utilizes the addition of quinalizarin solution to an acidified sample.
Cadmium	EPA SW-846 Method 7131[3]	Graphite furnace analysis at 228.8 nm with deuterium background correction. Ammonium phosphate was used as a modifier.
Calcium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	ASTM C 25 (36)[2]	Calcium is determined by EDTA titration in an alkaline solution after digestion in HCl. Insolubles are removed by filtration prior to analysis.

Table 2-1. Methods for General Metals Analyses of Gypsum (con.)

Parameter	Reference Method	Summary
Carbonate	See Instrumental Procedure Section.	Thermogravimetric Analysis.
	MHI Method WS-S-CO_2 (modified)[10]	Carbon dioxide is evolved from the decomposition of the sample in HCl. CO_2 is absorbed in a scrubbing solution of BaOH. The absorbing solution is back-titrated to determine carbonate concentration.
Chloride	ASTM C 114 (19)[2] (modified)	Silver-silver sulfide potentiometric measurement after nitric acid dissolution.
	Pure Air Method for Chloride[11]	Solid samples are slurried, heated, and stirred for 15 minutes. Liquid samples are diluted as required. Water soluble chloride is measured directly by ion selective electrode.
Chromium	EPA SW-846 Method 7190[3]	Flame atomic absorption analysis at 347.9 nm with a nitrous oxide-acetylene fuel rich flame.
Cobalt	EPA SW-846 Method 7201[3]	Modified graphite furnace analysis at 240.7 nm with a palladium in citric acid modifier solution.
Copper	Varian Analytical Methods[6]	Graphite furnace analysis at 324.8 nm with a palladium in citric acid modifier solution.
Cyanide	EPA SW-846 Method 9010[3]	Cyanide is evolved as hydrocyanic acid and collected in a sodium hydroxide scrubber. The solution is complexed with a pyridine reagent and measured colorimetrically.
Fluoride	PCA Test Method[13]	Ion selective electrode measurement technique. Sample was digested in HCl.
Iron	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.

Table 2-1. Methods for General Metals Analyses of Gypsum (con.)

Parameter	Reference Method	Summary
Lead	EPA SW-846 Method 7420[3]	Flame Atomic Absorption Analysis at 283.3 nm with deuterium background correction. An oxidizing air-acetylene flame was used.
Lithium	Varian Analytical Methods[6]	Graphite furnace analysis at 670.8 nm with a palladium in citric acid modifier solution.
Magnesium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	ASTM C 25 (36)[2]	Sample is digestion in HCl and insolubles are removed by filtration. Magnesium is determined by EDTA titration in a pH 10 buffered solution.
Manganese	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Mercury	EPA SW-846 Method 7471[3]	Cold vapor analysis at 253.7 nm. using stannous sulfate as a reductant. Digestion procedure includes aqua regia and potassium permanganate. Excess permanganate is reduced with sodium chloride-hydroxylamine sulfate.
Molybdenum	Varian Analytical Methods[6]	Graphite furnace analysis at 313.3 nm with a palladium in citric acid modifier solution.
Nickel	EPA SW-846 Method 7520[3]	Flame AA analysis with an oxidizing air-acetylene flame at 352.4 nm. and deuterium background correction.
Potassium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Selenium	EPA SW-846 Method 7740[3]	Modified graphite furnace analysis at 196.0 nm with deuterium background correction. Palladium in citric acid was used as a modifier.

Table 2-1. Methods for General Metals Analyses of Gypsum (con.)

Parameter	Reference Method	Summary
Silicon	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	MHI Method WS-S-Si 01[10] and ASTM C 25 (10)[2]	Initial method collects SiO_2 and insoluble matter through repeated digestions in HCl. The sample is filtered and the residue is ignited and weighed. The ASTM method then volatilizes the silica from the previously ignited residue with hydrofluoric acid. The sample is dried at 1000°C for a few minutes, cooled, and weighed. The SiO_2 content is the difference in weight between the residues ratioed to the original mass of the sample.
Silver	EPA SW-846 Method 7761[3]	Flame AA analysis at 328.1 nm with an air-acetylene flame.
Sodium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Sulfate	ASTM C 471 (13)[2]	Sample is digested in HCl and the sulfate is precipitated with barium chloride. The sample is filtered, dried, and ignited. Gravimetric determination is based on recovery of barium sulfate.
	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Sulfide (acid soluble)	ASTM C 114 (15.2)[2]	Sulfide as H_2S is liberated and captured in a solution of zinc sulfate. This form of sulfur is titrated with potassium iodate.
Sulfide (pyritic)	ASTM D 2492 (7)[1]	Sample is treated with nitric acid after removal of all acid soluble (HCl) and iron. Iron is measured by FAAS and sulfide from the pyrite is calculated stoicheometrically.

Table 2-1. Methods for General Metals Analyses of Gypsum (con.)

Parameter	Reference Method	Summary
Sulfite	EPRI Method 40[7]	Sample is added to a known amount of excess iodine solution and buffered with sodium acetate. A back-titrated with sodium thiosulfate determines sulfite levels.
Titanium	See Instrumental *Procedure Section.*	X-ray Fluorescence Spectrometry.
Tin	Varian Analytical Methods[6]	Graphite furnace analysis with palladium in citric acid modifier.
Uranium		Radiochemical technique analyzes for alpha-emitting nuclides with an alpha spectrometer using isotope dilution methods.
Vanadium	Varian Analytical Methods[6]	Graphite furnace analysis at 318.5 nm with a palladium citric acid modifier.
Zinc	SW-846 Method 7950[3]	Flame AA analysis at 213.9 nm with an air-acetylene flame.

GYPSUM WALLBOARD MANUFACTURER SPECIFICATIONS

The chemical composition of the gypsum by-product is assayed to determine the suitability of the material for wallboard manufacturing purposes. The parameters found in the following table are those of common interest to the wallboard manufacturing industry.

Table 2-2. Analytical Methods for Gypsum Wallboard Manufacturing

Parameter	Reference Method	Summary
Gypsum Purity ($CaSO_4 \cdot 2H_2O$)		Gypsum composition for contractual purposes is defined as the summation of wt. % values for combined water, calcium, and sulfate.
Calcium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	ASTM C 25 (36)[2]	Calcium is determined by EDTA titration in an alkaline solution after digestion in HCl. Insolubles are removed by filtration prior to analysis.
Sulfate	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	ASTM C 471 (13)[2]	Sample is digested in HCl and the sulfate is precipitated with barium chloride. The sample is filtered, dried, and ignited. Gravimetric determination is based on recovery of barium sulfate.
Combined Water	ASTM C 471 (7)[2]	Oven dried (forced air) at 230°C to constant weight.
Calcium Sulfite Hemihydrate ($CaSO_3 \cdot 1/2\ H_2O$)	EPRI Method 40[7]	Sample is added to a known amount of excess iodine solution, buffered with sodium acetate and back-titrated with sodium thiosulfate. Endpoint is determined when the blue color from the starch has dissipated.

Table 2-2. Analytical Methods for Gypsum Wallboard Manufacturing (con.)

Parameter	Reference Method	Summary
Silica (SiO_2)	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	MHI Method WS-S-Si 01[10] and ASTM C 25 (10)[2]	Initial method collects SiO_2 and insoluble matter through repeated digestions in HCl. The sample is filtered and the residue is ignited and weighed. The ASTM method then volatilizes the silica from the previously ignited residue with hydrofluoric acid. The sample is dried at 1000°C for a few minutes, cooled, and weighed. The SiO_2 content is the difference in weight between the residues ratioed to the original mass of the sample.
Iron	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	MHI Method WS-S-Fe 03[10]	Colorimetric technique which digests the sample in HCl and reduces the iron with hydroxylamine hydrochloride. The solution is neutralized and the iron is complexed with o-phenanthroline.
Aluminum	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	MHI Method WS-S-Al 03[10]	Sample is digested in hot aqua regia, taken to dryness, and dissolved in HCl. The solution is buffered and aluminon is added to complex the aluminum. The intensity of the red-colored complex is proportional to the aluminum concentration.
Total Metal Oxides (R_2O_3)		Calculation based on the sum of separate determinations of iron and aluminum by XRF or wet chemical analyses.

Table 2-2. Analytical Methods for Gypsum Wallboard Manufacturing (con.)

Parameter	Reference Method	Summary
pH	USG Method 113A[12]	Oven dry sample at 45°C overnight, pass through 100 mesh screen and redry for 2 hrs. Add 100 ml DI water to 10 g. of sample, cover, and measure with pH probe after 15 minutes.
Free Moisture	ASTM C 471 (6)[2]	Oven dried (forced air) at 45°C to constant weight.
Chloride	ASTM C 114 (19)[2] (modified)	Silver-silver sulfide potentiometric measurement after nitric acid dissolution.
	Pure Air Method for Chloride[11]	Solid samples are slurried, heated, and stirred for 15 minutes. Liquid samples are diluted as required. Water soluble chloride is measured directly by ion selective electrode.
Water Soluble Salts	USG-AA Method for Water Soluble Salts[12]	Calculation based upon moles of Na^+, K^+, and Mg^{++} that are available to combine with Cl^- and $SO4^{2-}$. Cations are quantified by a water soluble extraction method with subsequent analysis by FAAS.
Mean Particle Size	Sedigraph 5000E	Equivalent spherical diameter obtained from a X-Ray sedimentation particle size distribution curve at a cumulative mass of 50 %.

PARTICLE SIZE ANALYSIS

Particle size data of interest is obtained from a distribution curve generated by a Sedigraph 5000E sedimentation instrument. The particle size analyzer provides output in the form of a graph which plots equivalent spherical diameter versus cumulative mass percent. Further details on this technique can be found in the section on instrumental procedures.

TCLP METHODS

The TCLP methods employed for gypsum characterization were designed to determine the mobility of inorganic analytes present in this solid waste. EPA SW-846 Method 1311 outlines the procedures which are required to prepare the sample for analysis. The solid waste is extracted with acetic acid or an acetic acid / sodium hydroxide solution depending on the pH of the solid phase. The 20:1 extraction takes place over a period of 18 hrs. on a rotary agitator. The slurry is filtered and the filtrate is defined as the TCLP extract. This extract is used as the sample in the analytical procedures listed below.

Table 2-3. Gypsum TCLP Analytical Methods

Parameter	Reference Method	Summary
Arsenic	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 193.696 nm.
Barium	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 455.403 nm.
Cadmium	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 226.502 nm.
Corrosivity-pH	EPA SW-846 Method 9045[3]	An electrochemical procedure which measures the pH of the supernatant portion of a 1:1 dispersion of a sample in high purity water.
Chromium	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 267.716nm.
Mercury	EPA SW-846 Method 7470[3]	Mercury is reduced to the elemental form and is aerated from solution. The vapor passes through a closed system and into the light path of an AA spectrophotometer. Absorbance is measured at 253.7 nm. as a function of concentration.

Table 2-3. Gypsum TCLP Analytical Methods (con.)

Parameter	Reference Method	Summary
Ignitability	40 CFR 261.21[5]	Vigorous and persistent burning when sample is ignited.
Lead	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 220.353 nm.
Reactive Cyanide	EPA SW-846 Method 9010[3]	Cyanide is evolved as hydrocyanic acid and collected in a sodium hydroxide scrubber. The solution is complexed with a pyridine reagent and measured colorimetrically.
Reactive Sulfide	EPA SW-846 Method 9030[3]	Sample is pretreated with zinc acetate. Hydrogen sulfide is evolved through acidification in a closed system. Analysis is performed using an iodine sodium-thiosulfate back titration.
Selenium	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 196.026 nm.
Silver	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 328.068 nm.
Total Solids	Std. Method 209 F[9]	Solid samples are dried to a constant weight at 103-105 °C.

INDIANA NEUTRAL LEACHATE TEST

The purpose of The Indiana Neutral Leachate Test (INLT) test is to provide further characterization of the waste stream for waste classification purposes. The Indiana Department of Environmental Management has identified maximum permissible levels for certain water soluble constituents which may be present in the waste stream. The INLT sample preparation procedure is identical to that of the TCLP Method 1311 except for the type of fluid used in the extraction process. Deionized water is substituted for the acetic acid solutions that are used in the TCLP extraction. All other procedures found in Method 1311 are carried out. This extract is then subjected to the following analytical procedures.

Table 2-4. Indiana Neutral Leachate Methods for Gypsum

Parameter	Reference Method	Summary
Barium	EPA SW-846 Method 7080[3]	Atomic absorption spectroscopy at 553.6 nm. with a nitrous oxide/ acetylene flame and KCl as an ionization suppressant.
Boron	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy.
Chloride	Std. Method 407 B[9]	Mercuric nitrate titration. Chloride is titrated with mercuric nitrate to form a soluble, slightly dissociated mercuric chloride. Endpoint is determined by a purple complex resulting from the presence of diphenylcarbazone with excess mercuric ions.
Copper	EPA SW-846 Method 7210[3]	Atomic absorption spectroscopy at 324.7 nm. with a lean oxidizing flame.
Cyanide (Amenable)	EPA Method 335.1[4]	Sample is chlorinated at pH > 11 to decompose cyanide. EPA Method 335.2 (total cyanide) is then used for the determination.

Table 2-4. Indiana Neutral Leachate Methods for Gypsum (con.)

Parameter	Reference Method	Summary
Cyanide (Total)	EPA Method 335.2[4]	Cyanide is evolved as hydrocyanic acid and collected in a sodium hydroxide scrubber. The solution is either titrated with silver nitrate or complexed with a pyridine reagent and measured colorimetrically.
Fluoride	EPA method 340.1[4]	Sample is distilled and the fluoride is reacted with a SPADNS reagent. Loss of color is measured colorimetrically and is a function of fluoride level.
Iron	EPA SW-846 Method 7380[3]	Atomic absorption spectroscopy at 248.3 nm. with a lean oxidizing flame and background correction.
Manganese	EPA SW-846 Method 7460[3]	Atomic absorption spectroscopy at 279.5 nm. with a lean oxidizing flame and background correction.
Nickel	EPA SW-846 Method 7520[3]	Atomic absorption spectroscopy at 232.0 nm. with a lean oxidizing flame and background correction.
pH	EPA Method 150.1[4]	Hydrogen ion activity is measured potentiometrically using a glass and reference electrode.
Phenolics (Total)	EPA Method 420.1[4]	Formation of a red-brown anti-pyrine dye is measured colorimetrically and the color produced is a function of phenolic material.
Sodium	EPA SW-846 Method 7770[3]	Atomic absorption spectroscopy at 589.6 nm. with a lean oxidizing flame. The use of an ionization suppressant is recommended.
Sulfate	EPA Method 375.4[4]	Turbidimetric method reacts sample with barium chloride to precipitate barium sulfate. Absorbance is measured with a spectrophotometer and plotted on a calibration curve of known sulfate standards.

Table 2-4. Indiana Neutral Leachate Methods for Gypsum (con.)

Parameter	Reference Method	Summary
Sulfides (Total)	Std. Method 427 C[9]	Sulfide, ferric chloride, and dimethyl-p-phenylenediamine are reacted to produce methyene blue. Ammonium phosphate is added to remove color due to ferric chloride. Absorbance is measured with a spectrophotometer.
TDS	EPA Method 160.1[4]	Sample is filtered through a glass fiber filter. The filtrate is evaporated and dried to a constant weight at 180 °C.
Zinc	EPA SW-846 Method 7950[3]	Atomic absorption spectroscopy at 213.9 nm. with a lean oxidizing flame and background correction.

PROCESS SLURRY ANALYTICAL PROCEDURES

Analytical methods used to monitor daily process performance are summarized in the following section. The process areas of interest include filtrate sump, thickener overflow, thickener underflow, gypsum by-product, and absorber operations. The methods summarized in Table 2-6 are directed towards procedures which are performed on-site at the Bailly FGD laboratory. XRF methods[13] were used to provide results on trace metals analyses (Fe, Al, Mn, Si, Na, K) on samples acquired from these process streams during Demonstration Test #3.

Table 2-6. FGD Process Stream Analytical Methods

Parameter	Reference Method	Summary
Wt. % Solids	EPRI Method 13[7]	Gravimetric procedure vacuum filters a known amount of slurry and dries the filter cake at 45°C for three hours.
Density	EPRI Method 10[7]	Calibrated volumetric flask is filled with slurry and weighed. Mass of the slurry is divided by the flask volume.
Chloride	Pure Air Method for Chloride[11]	Solid samples are slurried, heated, and stirred for 15 minutes. Liquid samples are diluted as required. Water soluble chloride is measured directly by ion selective electrode.
Fluoride	Pure Air Method for Fluoride[11]	Solid samples are slurried, acidified with HNO_3, and heated/stirred for 15 minutes. Slurries are analyzed directly. After cooling, fluoride levels are determined potentiometrically by ion selective electrode.
Calcium	ASTM C 25 (36)[2]	Calcium is determined by EDTA titration in an alkaline solution after digestion in HCl. Insolubles are removed by filtration prior to analysis.

Table 2-6. FGD Process Stream Analytical Methods (con.)

Parameter	Reference Method	Summary
Carbonate	MHI Method WS-S-CO_2 (modified)[10]	Carbon dioxide is evolved from the decomposition of the sample in HCl. CO_2 is absorbed in a scrubbing solution of BaOH. The absorbing solution is back-titrated to determine carbonate concentration.
Magnesium	ASTM C 25 (36)[2]	Sample is digestion in HCl and insolubles are removed by filtration. Magnesium is determined by EDTA titration in a pH 10 buffered solution.
Silica	MHI Method WS-S-Si 01[10] and ASTM C 25 (10)[2]	Initial method collects SiO_2 and insoluble matter through repeated digestions in HCl. The sample is filtered and the residue is ignited and weighed. The ASTM method then volatilizes the silica from the previously ignited residue with hydrofluoric acid. The sample is dried at 1000°C for a few minutes, cooled, and weighed. The SiO_2 content is the difference in weight between the residues ratioed to the original mass of the sample.
Iron	MHI Method WS-S-Fe 03[10]	Colorimetric technique which digests the sample in HCl and reduces the iron with hydroxylamine hydrochloride. The solution is neutralized and the iron is complexed with o-phenanthroline.
Aluminum	MHI Method WS-S-Al 03[10]	Sample is digested in hot aqua regia, taken to dryness, and dissolved in HCl. The solution is buffered and aluminon is added to complex the aluminum. The intensity of the red-colored complex is proportional to the aluminum concentration.
pH	USG Method 113A[12]	Oven dry sample at 45°C overnight, pass through 100 mesh screen and redry for 2 hrs. Add 100 ml DI water to 10 g. of sample, cover, and measure with pH probe after 15 minutes.

SECTION 6.2 PURE AIR ANALYTICAL TESTING PROGRAM

6.2.1 Sample Acquisition, Sampling, Identification

6.2.2 Analytical Methodology

6.2.3 Laboratory Operation

6.2.4 References

CONTENTS

FIGURES

TABLES

SECTION SUMMARY

This document serves as a reference source for addressing the sampling protocol, analytical testing methods, and laboratory functions associated with the operation of the Pure Air flue gas desulfurization facility. This FGD unit is located at the Northern Indiana Public Service Company's Bailly Generating Station in Chesterton, Indiana.

This document is comprised of four sections. Section 1 describes the sample locations throughout the FGD facility which were used to monitor the performance of the system during various testing programs. Photographs of each sample point are provided along with a brief description of the location with respect to the overall FGD process. Sample acquisition and preservation techniques for each process stream are also outlined in this section.

Section 2 summarizes the analytical testing methods which were used to characterize the raw materials, process intermediates, and by-products associated with the operation of the FGD facility. Detailed information on specific test methods can be obtained by referencing the appropriate source document. Major types of analytical instrumentation and their principles of operation which were used to support the physical and chemical testing process are described in this section.

A description of overall laboratory operations is provided in Section 3. This section of the document discusses the internal functions of the Bailly laboratory of which its primary function is to provide daily reporting of key physical and chemical parameters used to monitor system performance. Discussions on external contract laboratory testing support, laboratory design including analytical equipment and supplies, quality control/quality assurance programs, laboratory safety, and recordkeeping are included in this section.

A list of references cited in the section on analytical methodology is presented in Section 4. These reference sources document detailed test methods used to: characterize FGD process streams during DOE demonstration tests, fulfill environmental monitoring plan reporting requirements, and assess routine FGD system performance.

SECTION 6.0 APPENDIX

SECTION 6.1 COAL ANALYSIS

PURE AIR'S
ADVANCED FLUE GAS DESULFURIZATION (AFGD)
CLEAN COAL TECHNOLOGY DEMONSTRATION PROJECT

DEMONSTRATION III

COAL ANALYSIS

ULTIMATE ANALYSIS (AS REC'D)

	WEIGHT %
CARBON	62.10
HYDROGEN	4.09
NITROGEN	1.22
SULFUR	3.12
OXYGEN	8.19
CHLORINE	0.06
MOISTURE	11.14
ASH	10.10

PROXIMATE ANALYSIS (AS REC'D)

	WEIGHT %	
	RANGE	AVERAGE
MOISTURE	11.80 - 15.82	13.20
ASH	9.48 - 13.20	10.80
SULFUR	2.82 - 3.96	3.10
BUT/LB AS RECEIVED	10,215 - 11,143	10,874

COAL ANALYSIS

PROXIMATE ANALY.

	ID	U	COAL	H2O	ASH CONT	SULFUR	BTU	DRY	AIR DRY	RESID
	NUMB	N	TYPE	WT %	WT%	WT%	BTU/LB	BTU/LB	MOIST	MOIST.
Y0810207	54594	7	ARCH-CAP	13.22	9.98	2.90	10957	14266.00	10.99	2.50
Y0810208	54593	8	ARCH-CAP	13.81	9.81	2.92	10928	14306.00	11.48	2.63
Y0811207	54596	7	RECLAIM	13.40	10.42	3.00	10886	14290.00	11.17	2.51
Y0811208	54595	8	RECLAIM	13.22	10.06	2.92	10936	14254.00	11.05	2.44
Y0812207	54598	7	ARCH-CAP	13.30	11.00	2.88	10850	14331.00	10.97	2.62
Y0812208	54597	8	ARCH-CAP	12.78	10.95	3.03	10944	14349.00	9.58	3.54
Y0813207	54798	7	ARCH-CAP	13.37	10.81	2.94	10922	14404.00	10.76	2.93
Y0813208	54753	8	ARCH-CAP	13.17	10.93	2.91	10837	14279.00	10.83	2.62
Y0814207	54754	7	ARCH-CAP	12.65	11.32	2.92	10962	14418.00	5.43	7.63
Y0814208	54600	8	ARCH-CAP	12.55	11.82	3.15	10892	14402.00	5.55	7.41
Y0815207	54756	7	RECLAIM	12.70	11.26	3.00	10933	14379.00	5.03	8.08
Y0815208	54755	8	RECLAIM	12.81	11.34	3.02	10904	14377.00	5.48	7.76
Y0816207	54169	7	ARCH-CAP	12.92	10.68	3.31	10984	14377.00	6.31	7.06
Y0816208	54758	8	ARCH-CAP	11.26	11.28	3.34	11151	14396.00	4.27	7.30
Y0817207	54760	7	ARCH-CAP	12.62	11.17	3.21	10924	14335.00	5.88	7.16
Y0817208	54759	8	ARCH-CAP	12.40	11.58	3.20	10832	14249.00	5.26	7.54
Y0818207	54763	7	RECLAIM	12.46	11.45	3.18	10985	14436.00	8.12	4.72
Y0818208	54762	8	RECLAIM	12.67	11.49	3.10	10972		1468.00	8.13
Y0819207	54764	7	ARCH-CAP	12.74	10.61	3.03	10994	14344.00	8.68	4.45
Y0819208	54765	8	ARCH-CAP	12.78	11.26	3.18	10973	14446.00	8.50	4.68
Y0820207	54766	7	ARCH-CAP	11.71	10.54	2.22	10993	14138.00	7.40	4.65
Y0821207	54767	7	ARCH-CAP	13.32	9.79	3.13	10938	14225.00	9.43	4.29
Y0822207	54768	7	ARCH-CAP	13.29	10.03	3.20	10943	14270.00	10.71	2.89
Y0823207	54769	7	ARACH-CAP	13.92	9.48	2.93	10933	14272.00	11.27	2.99
Y0824207	54771	7	ARCH-CAP	12.34	9.72	3.29	11143	14298.00	9.74	2.88
Y0825207	54772	7	ARCH-CAP	13.55	10.14	3.20	10910	14298.00	11.10	2.67
Y0826207	54773	7	RECLAIM	12.75	11.48	2.87	10802	14256.00	10.35	2.68
Y0827207	54774	7	ARCH-CAP	13.85	10.89	3.26	10721	14246.00	11.53	2.62
Y0827208	54776	8	ARCH-CAP	13.21	10.69	3.20	10806	14199.00	10.86	2.64
Y0828207	54777	7	ARCH-CAP	13.61	9.99	3.33	10875	14234.00	4.88	9.18
Y0828208	54777	7	ARCH-CAP	13.61	9.99	3.33	10875	14234.00	4.88	9.18
Y0829207	54781	7	ARCH-CAP	13.59	10.41	3.13	10808	14222.00	9.90	4.09

COAL ANALYSIS

PROXIMATE ANALY.

	ID	U	COAL	H2O	ASH CONT	SULFUR	BTU	DRY	AIR DRY	RESID
	NUMB	N	TYPE	WT %	WT%	WT%	BTU/LB	BTU/LB	MOIST	MOIST.
Y0829208	54780	8	ARCH-CAP	13.41	10.96	3.20	10791	14267.00	9.75	4.06
Y0830207	54855	7	ARCH-CAP	13.23	10.71	3.11	10904	14336.00	9.20	4.44
Y0830208	54856	8	ARCH-CAP	12.57	10.61	3.06	10993	14310.00	4.11	8.82
Y0831208	54782	8	ARCH-CAP	13.08	10.62	3.15	10892	14275.00	9.24	4.23
Y0831207	54784	7	RECLAIM	12.95	10.88	3.14	10857	14255.00	8.64	4.72
Y0901207	54797	7	ARCH-CAP	12.43	11.06	3.23	10918	14271.00	8.86	3.92
Y0901208	54785	8	ARCH-CAP	12.74	10.77	3.06	10947	14312.00	9.32	3.77
Y0902207	54796	7	RECLAIM	12.20	10.43	3.08	10931	14127.00	7.90	4.67
Y0902208	54795	8	RECLAIM	12.80	10.28	3.12	11040	14352.00	8.57	4.63
Y0903207	54789	7	ARCH-CAP	12.82	10.76	3.09	10958	14339.00	8.65	4.56
Y0903208	54790	8	ARCH-CAP	13.19	10.94	3.18	10859	14314.00	8.89	4.72
Y0904207	54852	7	RECLAIM	13.82	10.53	3.03	10818	14300.00	10.38	3.84
Y0904208	54788	8	ARCH-CAP	13.56	11.92	3.01	10606	14232.00	9.86	4.11
Y0905202	54857	8	ARCH-CAP	13.31	10.07	3.14	10999	14355.00	9.84	3.85
Y0905207	54858	7	ARCH-CAP	13.12	10.02	3.00	10989	14297.00	9.09	4.43
Y0905208	54857	8	ARCH-CAP	13.31	10.07	3.14	10999	14355.00	9.84	3.85
Y0906207	54863	7	ARCH-CAP	12.65	10.36	3.24	11056	14361.00	8.50	4.54
Y0906208	54864	8	ARCH-CAP	12.86	10.19	3.12	11098	14422.00	8.85	4.40
Y0907207	54868	7	RECLAIM	13.46	10.41	3.01	10820	14212.00	9.19	4.70
Y0907208	54866	8	?	12.23	10.31	3.45	11101	14331.00	7.93	4.67
Y0908207	54870	7	RECLAIM	12.78	10.23	3.16	10968	14246.00	8.63	4.54
Y0908208	54869	8	RECLAIM	13.17	10.40	3.22	10895	14255.00	9.18	4.39
Y0909207	54873	7	?	15.82	10.77	3.11	10547	14368.00	12.06	4.27
Y0909208	54872	8	RECLAIM	14.46	10.69	2.95	10722	14324.00	10.77	4.14
Y0909209	54871	8	ARCH-CAP	12.68	10.79	3.22	10982	14351.00	9.23	3.80
Y0910207	54874	7	ARCH-CAP	14.65	10.99	3.05	10754	14462.00	9.47	5.72
Y0910208	54876	8	RECLAIM	15.18	10.77	3.09	10298	13907.00	10.57	5.15
Y0910209	54875	8	ARCH-CAP	14.60	11.56	3.05	10695	14483.00	9.93	5.18
Y0911207	54877	7	ARCH-CAP	14.56	11.96	3.13	10215	13091.00	9.84	5.24
Y0911208	54878	8	ARCH-CAP	14.60	10.86	3.01	10695	14347.00	10.26	4.84
Y0912207	54881	7	ARCH-CAP	13.31	13.20	3.96	10654	14497.00	8.53	5.23
Y0912208	54880	8	ARCH-CAP	12.95	12.27	3.74	10740	14363.00	8.27	5.10

COAL ANALYSIS

PROXIMATE ANALY.

	ID	U	COAL	H2O	ASH CONT	SULFUR	BTU	DRY	AIR DRY	RESID
	NUMB	N	TYPE	WT %	WT%	WT%	BTU/LB	BTU/LB	MOIST	MOIST.
Y0913207	54882	7	ARCH-CAP	12.87	12.54	3.21	10770	14440.00	8.53	4.75
Y0913208	54883	8	ARCH-CAP	13.07	12.17	3.25	10724	14344.00	9.23	4.23
Y0914207	54890	7	ARCH-CAP	12.88	11.51	3.17	10891	14405.00	8.98	4.28
Y0914208	54889	8	ARCH-CAP	12.63	11.81	3.15	10824	14327.00	8.48	4.53
Y0915207	54893	7	RECLAIM	13.45	11.30	3.30	10736	14268.00	9.06	4.83
Y0915208	54892	8	RECLAIM	13.15	11.51	3.36	10640	14123.00	8.84	4.73
Y0916208	54804	8	RECLAIM	13.65	10.36	3.04	10782	14190.00	10.19	3.85
Y0917200	54117		ARCH-CAP	12.48	11.60	3.20	10926	14391.00	8.55	4.30
Y0917207	54805	7	ARCH-CAP	12.51	11.06	3.06	10882	14239.00	9.18	3.67
Y0917208	54801	8	ARCH-CAP	12.70	11.52	3.14	10787	14235.00	9.01	4.05
Y0918207	54807	7	ARCH-CAP	13.59	10.08	2.82	10884	14259.00	10.57	3.38
Y0918208	54806	8	ARCH-CAP	12.83	10.44	3.15	11042	14391.00	9.90	3.25
Y0919207	54808	7	ARCH-CAP	13.00	10.50	3.20	10939	14299.00	10.13	3.19
Y0919208	54809	8	ARCH-CAP	11.80	10.31	3.14	11126	14285.00	8.66	3.44
Y0920207	54813	7	ARCH-CAP	12.84	10.58	3.15	10913	14249.00	9.38	3.82
Y0920208	54812	8	ARCH-CAP	13.31	10.53	2.83	10829	14219.00	10.31	3.35
Y0921207	54897	7	RECLAIM	13.98	10.91	3.25	10749	14311.00	10.55	3.83
Y0921208	54886	8	RECLAIM	14.15	10.29	3.07	10799	14292.00	11.12	3.41
Y0922207	54816	7	RECLAIM	14.46	10.44	3.13	10744	14306.00	11.91	2.90
Y0922208	54817	8	RECLAIM	13.81	10.38	3.08	10851	14313.00	10.79	3.39
Y0923207	54819	7	RECLAIM	12.82	10.34	3.10	10960	14264.00	9.82	3.33
Y0923208	54818	8	RECLAIM	12.91	10.06	3.09	10990	14268.00	9.76	3.49
Y0924207	54811	7	?	12.91	10.44	3.23	10901	14221.00	9.69	3.56
Y0924208	54900	8	RECLAIM	12.82	10.44	3.03	10936	14250.00	9.41	3.76
Y0925207	54821	7	ARCH-CAP	13.38	10.99	3.05	10781	14254.00	9.88	3.88
Y0925208	54820	8	ARCH-CAP	13.13	11.41	3.23	10746	14241.00	9.79	3.70
Y0926207	54822	7	ARCH-CAP	13.64	11.11	3.04	10714	14238.00	9.32	4.65
Y0926208	54823	8	ARCH-CAP	14.30	10.85	2.96	10706	14304.00	10.32	4.44
Y0927207	54824	7	ARCH-CAP	13.90	11.12	3.13	10698	14268.00	10.39	3.92
Y0928207	54826	7	ARCH-CAP	13.66	11.19	3.17	10717	14260.00	10.72	3.29
Y0929207	54827	7	RECLAIM	13.50	10.77	3.19	10773	14225.00	10.14	3.74
Y0929208	54828	8	?	13.23	10.72	3.10	10830	14240.00	10.30	3.27

COAL ANALYSIS

PROXIMATE ANALY.

	ID	U	COAL	H2O	ASH CONT	SULFUR	BTU	DRY	AIR DRY	RESID
	NUMB	N	TYPE	WT %	WT%	WT%	BTU/LB	BTU/LB	MOIST	MOIST.
Y0930207	54830	7	RECLAIM	12.62	11.11	3.04	10967	14380.00	9.59	3.35
Y0930208	54829	8	ARCH-CAP	12.67	11.18	3.26	10943	14370.00	10.02	2.95
Y1001207	54833	7	RECLAIM	12.67	11.34	3.24	10806	14221.00	9.40	3.61
Y1001208	54831	8	RECLAIM	13.01	11.65	3.14	10928	15405.00	8.93	4.48

SECTION 6.2.1

SAMPLE ACQUISITION, HANDLING, AND IDENTIFICATION

This section provides a description of the process stream sampling locations and collection procedures which are utilized to obtain representative samples for laboratory analysis. Methods for acquiring and preserving samples from eight process streams within the FGD facility are discussed separately. Parameters which require immediate attention at the sampling site due to the nature of their stability are also discussed.

The individual assigned to collect samples should perform the following checklist of activities prior to going out to the designated sampling area in the plant.

1. Obtain enough clean, dry sample bottles for the number of desired sample locations. Ensure that any previous sample coding has been removed from the exterior of the bottle. Label the bottles with the new sample code. Record the sample identification on the logsheet.

2. Run a diagnostic and calibration test on the portable pH meter. The meters used at this facility have automatic temperature compensation and provide a temperature readout. This eliminates the need for correcting pH results and using thermometers.

3. Add known amounts of chemical preservatives into separate sample bottles and label with the appropriate sample ID and type of analysis requested (i.e. A0612207 - sulfite).

4. Miscellaneous items to be taken along with the individual while sampling include: disposable gloves, pen, note pad, sample logsheet, marking pen, stopwatch, graduated cylinder (Nalgene), and extra sample bottles. These items can be easily handled using a plastic tote carrier.

The individual should promptly return the samples and logsheet to the laboratory once the sample acquisition process has been completed.

Samples are coded by process stream location, month, day, year, and time of day. Each sample has its own unique eight digit code which is used for reporting analytical results, maintaining hardcopy data files, and for assigning file names for data entry and analysis purposes. Table 1-1 outlines the procedure for assigning an identification code to a sample.

Table 1-1. Sample Identification Procedure

Sample ID Code = L M M D D Y T T

where:

L = location of sample point (see list of options)
M = month (first digit)
M = month (second digit)
D = day of month (first digit)
D = day of month (second digit)
Y = year (last digit)
T = time of day (military time) rounded to the nearest hour

where location (L):

A = Absorber Bleed Pump	L = Limestone
C = Centrifuge Conveyor	P = Process Water
D = Centrifuge Feed	S = Special
E = Equalization Tank	T = Thickener Overflow
F = Filtrate Sump	U = Thickener Underflow
G = Gypsum (composite sampler)	W = Wastewater Effluent
I = Wastewater Influent	Y = Coal

A gypsum sample collected from the Ramsey composite sampler at 10:15 PM on June 18, 1992 would be assigned the sample code G0618222.

FGD SAMPLING LOCATIONS

Absorber Slurry

Absorber slurry samples are collected from the discharge piping off of the absorber bleed pump. The bleed pump directs slurry to the centrifuge feed tank and/or recycles slurry back to the absorber vessel. This sampling location (Figure 1-1) has been determined to provide a sample with the least amount of variation with respect to density and weight percent solids. The nuclear density analyzer is located in this area of the process and its performance can be monitored by density data provided by the lab. This sample point is continuously flowing, therefore no sample line purging is required.

Samples for laboratory analysis are collected in polyethylene bottles. Attention must be given to the process of filling the sample bottle and not allowing slurry to overflow from the top of the container. Overfilling the sample vessel will result in an inaccurate proportion of solids and liquids present in this segment of the process. The collection of a nonrepresentative sample will in turn initiate a large amount of inaccurate analytical data reported. A sample must be discarded and a new one obtained if the container is inadvertently overfilled. These samples are then transported to the FGD laboratory for physical and chemical testing.

Slurry samples for sulfite determination are collected directly into a separate bottle containing a premeasured amount of iodine solution. This procedure is carried out because sulfites are known to readily oxidize or volatilize unless they are preserved. Temperature and pH measurements on the absorber process stream are performed immediately at the sampling location.

Filtrate Sump

Filtrate sump samples are collected after the discharge of the filtrate sump pumps. These pumps typically direct the flow of this material to the thickener tank. Filtrate sump slurry consists of the following materials from the dewatering operation: (1) overflow from the charging of the centrifuges (2) filtrate removed during centrifuge operation and (3) process water used to wash the gypsum after the solids have been separated from the filtrate. At the time of sampling, a pinch valve on a vertical pipe is opened and the filtrate sump material is allowed to blow down for a period of time prior to sampling (Figure 1-2). A splash guard, which directs flow from an open pipe to a drain line equipped with a collection funnel, prevents spattering on nearby equipment.

Samples for laboratory analysis are collected in polyethylene bottles. Attention must be given to the process of filling the sample bottle and not allowing material to overflow from the top of the container. Overfilling the sample vessel will result in an inaccurate proportion of solids and liquids present in this segment of the process. The collection of a nonrepresentative sample will in turn initiate a large amount of inaccurate analytical data reported. A sample must be discarded and a new one obtained if the container is inadvertently overfilled. These samples are then transported to the FGD laboratory for physical and chemical testing.

Filtrate sump samples for sulfite determination are collected directly into a separate bottle containing a premeasured amount of iodine solution. This procedure is carried out because sulfites are known to readily oxidize to sulfate or volatilize to SO_2 unless they are preserved. Temperature and pH measurements on the filtrate sump process stream are performed immediately at the sampling location.

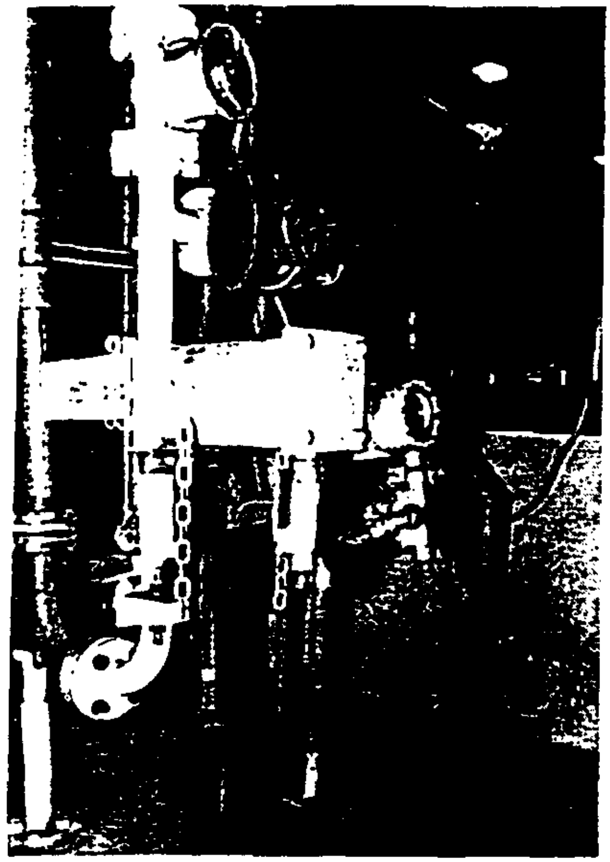


Figure 1-1. Absorber Slurry Sampling Location.

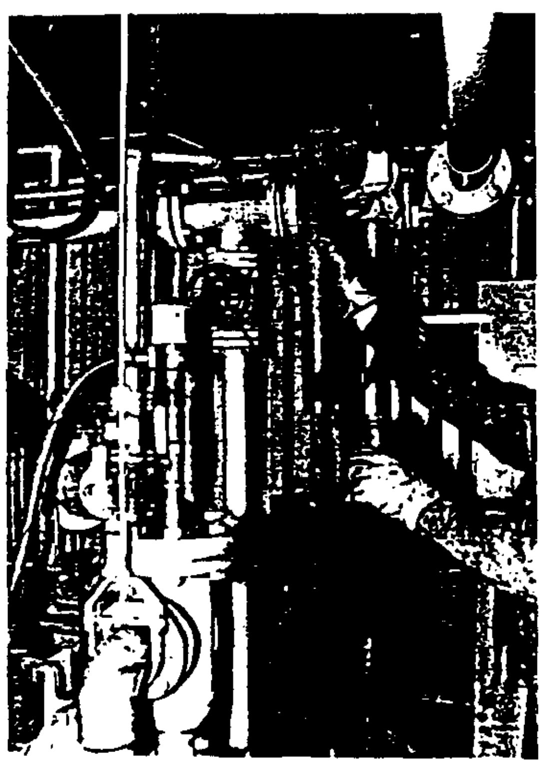


Figure 1-2. Filtrate Sump Sampling Location.

Thickener Underflow

Thickener underflow is sampled at the discharge of the thickener underflow pumps. Underflow material generally consists of the solids which have settled in the thickener tank. These pumps send the process slurry to the centrifuge feed tank or recycles back to the thickener. At the time of sampling, a block valve on vertical piping is opened and underflow material is allowed to blow down for a period of time before sampling (Figure 1-3). A splash guard, which directs slurry from an open pipe to a drain line fitted with a collection funnel, prevents spattering on nearby equipment.

Samples for laboratory analysis are collected in polyethylene bottles. Attention must be given to the process of filling the sample bottle and not allowing slurry to overflow from the top of the container. Overfilling the sample vessel will result in an inaccurate proportion of solids and liquids present in this segment of the process. The collection of a nonrepresentative sample will in turn initiate a large amount of inaccurate analytical data reported. A sample must be discarded and a new one obtained if the container is inadvertently overfilled. These samples are then transported to the FGD laboratory for physical and chemical testing.

Underflow samples for sulfite determination are collected directly into a separate bottle containing a premeasured amount of iodine solution. This procedure is carried out because sulfites are known to readily oxidize or volatilize unless they are preserved. Temperature and pH measurements on the thickener underflow process stream are performed immediately at the sampling location.

Thickener Overflow

Thickener overflow samples are collected at the combined discharge of the thickener overflow pumps. Thickener overflow is the supernatant liquid removed from the thickener tank which then is recycled to the absorber, directed to the filtrate sump, and/or sent to the wastewater treatment facility. At the time of sampling, a pinch valve on a vertical pipe is opened and the thickener overflow material is allowed to blow down for a period of time before sampling (Figure 1-4). A splash guard, which directs flow from an open pipe to a drain line equipped with a collection funnel, prevents spattering on nearby equipment.

Samples for laboratory analysis are collected in polyethylene bottles. Attention must be given to the process of filling the sample bottle and not allowing material to overflow from the top of the container. Overfilling the sample vessel will result in an inaccurate proportion of solids and liquids present in this segment of the process. The collection of a nonrepresentative sample will in turn initiate a large amount of inaccurate analytical data reported. A sample must be discarded and a new one obtained if the container is inadvertently overfilled. These samples are then transported to the FGD laboratory for physical and chemical testing.

Overflow samples for sulfite determination are collected directly into a separate bottle containing a premeasured amount of iodine solution. This procedure is carried out because sulfites are known to readily oxidize or volatilize unless they are preserved. Temperature and pH measurements on the thickener overflow process stream are performed immediately at the sampling location.

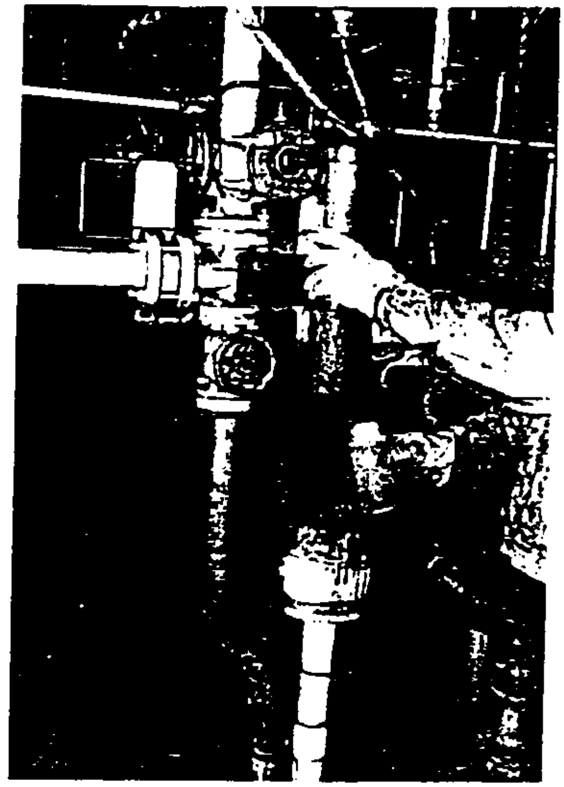


Figure 1-3. Thickener Underflow Sampling Location.

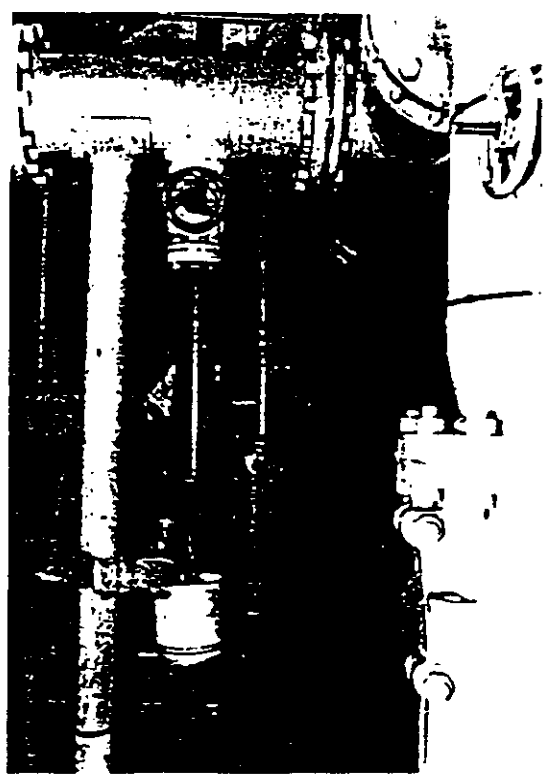


Figure 1-4. Thickener Overflow Sampling Location.

Gypsum By-Product

A conveyor belt transports the finished gypsum product from the dewatering building to the gypsum storage building. Gypsum samples are collected off of the conveyor belt through the use of a Ramsey 2100 Sweep Sampler (Figure 1-5). An interval timer specifies the time period in which to extract a sample of the material passing by on the belt. A mechanical arm sweeps the conveyor belt and directs the material through a feed chute and into a collecting receptacle. The sampler will not attempt to sweep the conveyor belt until the a significant load of gypsum is detected on the belt by a weight scale.

The gypsum is removed from the sampler's compositing container and passed through a riffler to reduce the sample size and to ensure a representative sample is collected from the sampling period. The piece of equipment is equipped with a vibrating mechanism to aid in passing the material through the riffler's chutes.

Free moisture analyses on gypsum samples are conducted as soon as the samples arrive at the FGD laboratory due to the stability of the moisture content of the material.

Process Water

Grab samples of process water are obtained from the main stream serving the FGD facility after passing through a strainer equipped with a 1/8 inch mesh screening (Figure 1-6). Process water is primarily used as make-up water for the absorber, wash water for the dewatering operation, and spray down of the mist eliminators . At the time of sampling, a drain valve located on the strainer is opened and water is allowed to blow down for a period of time prior to sampling. Samples of makeup water are collected and preserved for analysis in accordance with specifications found in Table 1-2.

Table 1-2. Process Water Sample Preservation

Parameter	Sample Type	Container	Preservative	Level
Cyanide, Sulfide	composite	poly bottle	NaOH (10 N)	pH > 12
Metals analyses	composite	poly bottle	HNO_3	0.5%
Nitrate	composite	poly bottle	H_2SO_4	0.2%
Oil and Grease	grab	glass jar	HCl (1:1)	5 ml.
Sulfite	grab	poly bottle	EDTA (2.5% w/v)	1 ml.

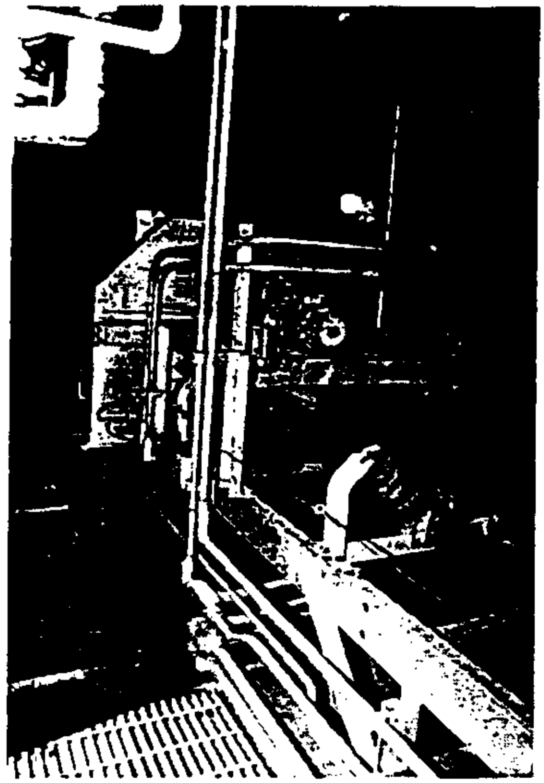


Figure 1-5. Ramsey Sweep Sampler and Gypsum Conveyor Belt Transporting Product to Storage Building.

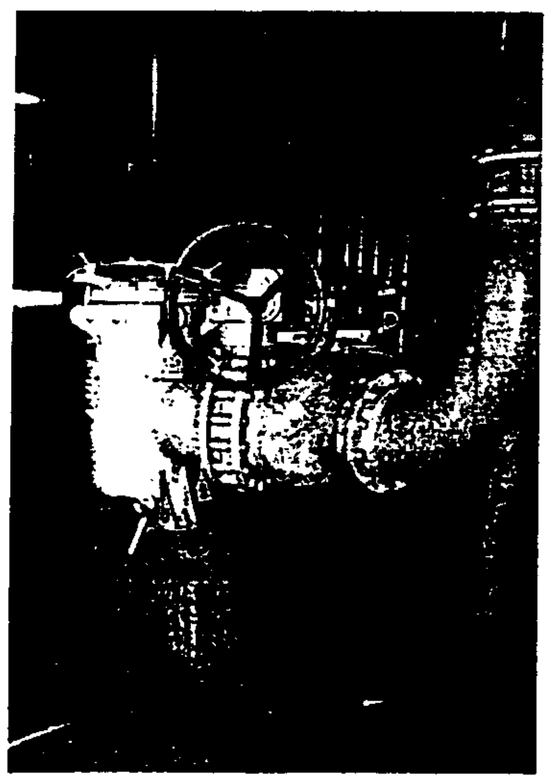


Figure 1-6. Process Water Sampling Location.

Wastewater Influent

An equalization tank acts as a holding vessel for process streams entering the wastewater treatment facility. Composite wastewater influent samples are drawn from a deep well located at the discharge of the forward feed pumps. These pumps provide forward flow to the wastewater treatment facility and are located between the equalization and neutralization tanks. A representative sample of the process stream can be obtained at this point because the equalization tank is well mixed and the influent has not yet undergone any chemical treatment.

An ISCO 3710 portable sampler (Figure 1-7) was programmed to generate composite wastewater influent samples. Uniform sample time intervals were used to configure the sampler. The ISCO sampler features an external liquid presence detector, a peristaltic pump and a patented pump revolution counting system which delivers accurate and repeatable sample volumes. Suction line rinsing assists in reducing sample cross contamination.

Upon completion of the sampling program, the collection bottle was removed from the sampler and the contents were well mixed. Portions of the composited sample were placed into appropriate containers and preserved in accordance with specifications found in Table 1-3.

Table 1-3. Wastewater Influent Sample Preservation

Parameter	Sample Type	Container	Preservative	Level
Cyanide, Sulfide	composite	poly bottle	NaOH (10 N)	pH > 12
Metals analyses	composite	poly bottle	HNO_3	0.5%
Oil and Grease	grab	glass jar	HCl (1:1)	5 ml.

Wastewater Effluent

Effluent from the wastewater treatment plant is composite sampled from a deep well pot located downstream from the discharge of the treated wastewater pumps. A valve controls the flow of this process stream into the main outfall of the utility.

An ISCO 3710 portable sampler (Figure 1-8) was configured to generate composite wastewater effluent samples. Uniform sample time intervals were used to program the sampler. The ISCO sampler features an external liquid presence detector, a peristaltic pump and a patented pump revolution counting system which delivers accurate and repeatable sample volumes. Suction line rinsing assists in reducing sample cross contamination.

Upon completion of the sampling program, the collection bottle was removed from the sampler and the contents were well mixed. Portions of the composited sample were placed into appropriate containers and preserved in accordance with specifications found in Table 1-4.

Table 1-4. Wastewater Effluent Sample Preservation

Parameter	Sample Type	Container	Preservative	Level
Cyanide, Sulfide	composite	poly bottle	NaOH (10 N)	pH > 12
Metals analyses	composite	poly bottle	HNO_3	0.5%
Oil and Grease	grab	glass jar	HCl (1:1)	5 ml.

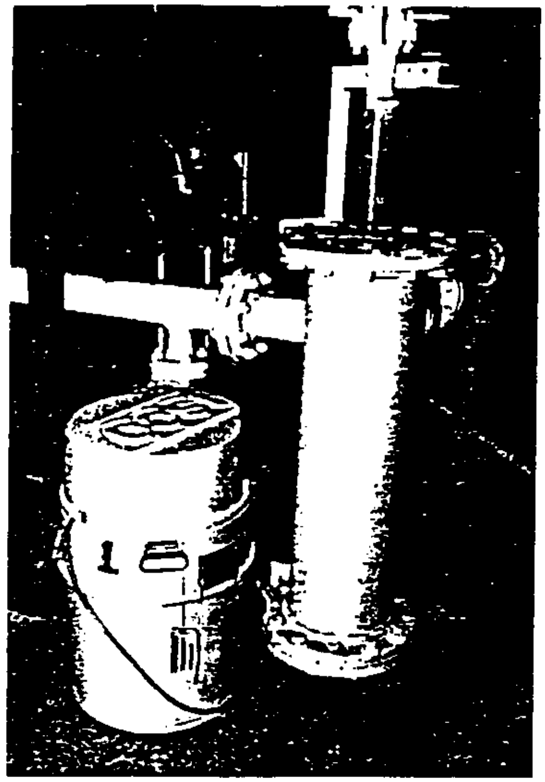


Figure 1-7. ISCO Sampler at Wastewater Influent Sampling Site.

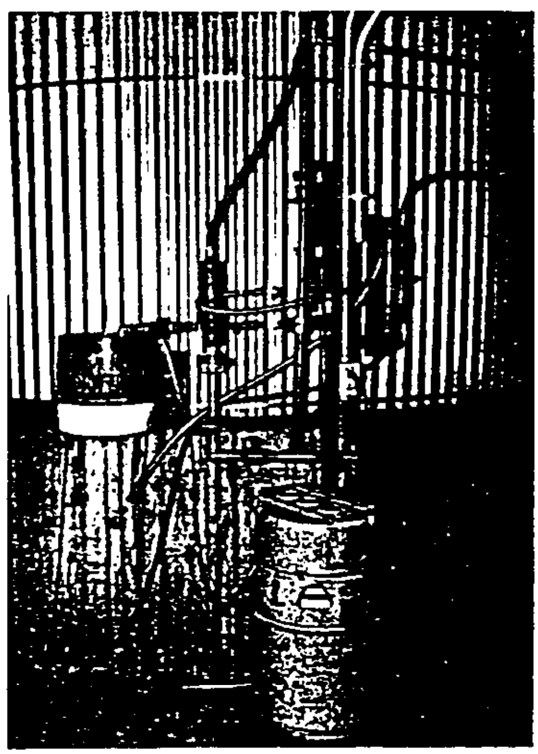


Figure 1-8. ISCO Sampler at Wastewater Effluent Sampling Site.

Table 2-6. FGD Process Stream Analytical Methods (con.)

Parameter	Reference Method	Summary
Sulfite (solid samples)	EPRI Method 40[7]	Sample is added to a known amount of excess iodine solution, buffered with sodium acetate and back-titrated with sodium thiosulfate. Endpoint is determined when the blue color from the starch has dissipated.
Sulfite (liquid samples)	MHI Method WS-A-SO_3[10]	Sample is collected in a known amount of excess iodine solution, acidified, The sample is back-titrated with sodium thiosulfate in the presence of starch to determine the endpoint.

LIMESTONE ANALYTICAL PROCEDURES

This section provides information on analytical procedures which characterizes limestone used at the Bailly facility. Limestone is consumed as a raw material in the FGD operation. This methods section is comprised of three elements which include general metals analyses, particle size distribution, and radioactivity.

Acid Digestion for Metals Analysis

The digestion procedure for metals analyses of limestone was performed using a modification of ASTM C 471-87 (9)[2]. This procedure was used to prepare samples for analysis by atomic absorption spectroscopy. Certain exceptions to the above method did apply and modifications were carried out as required. An example would be the analysis of silver where HCl cannot be used in the digestion process.

A sample of 0.5 to 1.0 grams was added to a 25 ml of HCL (1:5) and heated with mixing for 15 minutes. Evaporation to dryness steps in the ASTM procedure were eliminated. The solution was further heated for 10 minutes after the addition of 50 ml of hot water. The solution was cooled and transferred to a 100 ml volumetric flask. Concentrated nitric acid (2 ml.) was added to the vessel and made to volume with deionized water.

GENERAL METALS ANALYSIS

The analytical methodology summarized in the general metals section provides a brief description of the techniques used for major, minor, and trace elemental characterization of limestone used at the Bailly FGD facility.

Table 2-7. Methods for General Metals Analyses of Limestone

Parameter	Reference Method	Summary
Aluminum	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Antimony	EPA SW-846 Method 7041[3]	Graphite furnace analysis at 217.6 nm with deuterium background correction. Ammonium nitrate was used as a chemical modifier.
Arsenic	EPA SW-846 Method 7060[3]	Modified graphite furnace analysis at 193.7 nm with deuterium background correction. Palladium in citric acid was used as a modifier.
Barium	EPA SW-846 Method 7080[3]	Flame atomic absorption analysis at 553.6 nm with a nitrous oxide-acetylene fuel rich flame. Potassium chloride was used as an ionization suppressant.
Beryllium	EPA SW-846 Method 7091[3]	Graphite furnace analysis at 234.9 nm with deuterium background correction.
Boron	CTL Method[13]	Colorimetric method utilizes the addition of quinalizarin solution to an acidified sample.
Cadmium	EPA SW-846 Method 7131[3]	Graphite furnace analysis at 228.8 nm with deuterium background correction. Ammonium phosphate was used as a modifier.
Calcium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	ASTM C 25 (36)[2]	Calcium is determined by EDTA titration in an alkaline solution after digestion in HCl. Insolubles are removed by filtration prior to analysis.
Carbonate	See Instrumental Procedure Section.	Thermogravimetric Analysis.
Chloride	ASTM C 114 (19) (modified)[2]	Silver-silver sulfide potentiometric measurement after nitric acid dissolution.

Table 2-7. Methods for General Metals Analyses of Limestone (con.)

Parameter	Reference Method	Summary
Chromium	EPA SW-846 Method 7190[3]	Flame atomic absorption analysis at 347.9 nm with a nitrous oxide-acetylene fuel rich flame.
Cobalt	EPA SW-846 Method 7201[3]	Modified graphite furnace analysis at 240.7 nm with a palladium in citric acid modifier solution.
Copper	Varian Analytical Methods[6]	Graphite furnace analysis at 324.8 nm with a palladium in citric acid modifier solution.
Cyanide	EPA SW-846 Method 9010[3]	Cyanide is evolved as hydrocyanic acid and collected in a sodium hydroxide scrubber. The solution is complexed with a pyridine reagent and measured colorimetrically.
Fluoride	PCA Test Method[13]	Ion selective electrode measurement technique. Sample was digested in HCl.
Iron	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Lead	EPA SW-846 Method 7420[3]	Flame Atomic Absorption Analysis at 283.3 nm with deuterium background correction. An oxidizing air-acetylene flame was used.
Lithium	Varian Analytical Methods[6]	Graphite furnace analysis at 670.8 nm with a palladium in citric acid modifier solution.
Magnesium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
	ASTM C 25 (36)[2]	Sample is digestion in HCl and insolubles are removed by filtration. Magnesium is determined by EDTA titration in a pH 10 buffered solution.
Manganese	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.

Table 2-7. Methods for General Metals Analyses of Limestone (con.)

Parameter	Reference Method	Summary
Mercury	EPA SW-846 Method 7471[3]	Cold vapor analysis at 253.7 nm. using stannous sulfate as a reductant. Digestion procedure includes aqua regia and potassium permanganate. Excess permanganate is reduced with sodium chloride-hydroxylamine sulfate.
Molybdenum	Varian Analytical Methods[6]	Graphite furnace analysis at 313.3 nm with a palladium in citric acid modifier solution.
Nickel	EPA SW-846 Method 7520[3]	Flame AA analysis with an oxidizing air-acetylene flame at 352.4 nm. and deuterium background correction.
Nitrate	EPA Method 353.2[4]	Sample is extracted with hot water and a colorimetric cadmium reduction method is performed.
Potassium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Selenium	EPA SW-846 Method 7740[3]	Modified graphite furnace analysis at 196.0 nm with deuterium background correction. Palladium in citric acid was used as a modifier.
Silicon	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Silver	EPA SW-846 Method 7761[3]	Flame AA analysis at 328.1 nm with an air-acetylene flame.
Sodium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Sulfate	ASTM C 25 (25)[2]	Sample is digested in HCl and the sulfate is precipitated with barium chloride. The sample is filtered, dried, and ignited. Gravimetric determination is based on recovery of barium sulfate.
	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.

Table 2-7. Methods for General Metals Analyses of Limestone (con.)

Parameter	Reference Method	Summary
Sulfide (acid soluble)	ASTM C 114 (15.2)[2]	Sulfide as H_2S is liberated and captured in a solution of zinc sulfate. This form of sulfur is titrated with potassium iodate.
Sulfide (pyritic)	ASTM D 2492 (7)[1]	Sample is treated with nitric acid after removal of all acid soluble (HCl) sulfide and iron. Iron is measured by FAAS and sulfide from the pyrite is calculated stoicheometrically.
Sulfite (solid samples)	EPRI Method 40[7]	Sample is added to a known amount of excess iodine solution, buffered with sodium acetate and back-titrated with sodium thiosulfate. Endpoint is determined when the blue color from the starch has dissipated.
Titanium	See Instrumental Procedure Section.	X-ray Fluorescence Spectrometry.
Tin	Varian Analytical Methods[6]	Graphite furnace analysis with palladium in citric acid modifier.
Uranium		Radiochemical technique analyzes for alpha-emitting nuclides with an alpha spectrometer using isotope dilution methods.
Vanadium	Varian Analytical Methods[6]	Graphite furnace analysis at 318.5 nm with a palladium citric acid modifier.
Zinc	EPA SW-846 Method 7950[3]	Flame AA analysis at 213.9 nm with an air-acetylene flame.

PARTICLE SIZE ANALYSIS

Particle size data of interest is obtained from a distribution curve generated by a Sedigraph 5000E sedimentation instrument. The particle size analyzer provides output in the form of a graph which plots equivalent spherical diameter versus cumulative mass percent. Further details on this technique can be found in the instrumental procedures section.

RADIOACTIVITY

Limestone radioactivity parameters itemized in Table 2-8 were evaluated to address potential environmental concerns. Teledyne Isotopes, a reputable contract laboratory providing analytical services in the field of radioactivity, performed the studies on the limestone consumed at the Bailly FGD facility.

Table 2-8. Radioactivity Methods for Limestone

Parameter	Reference Method	Summary
Gross Alpha		Sample is dispersed on a ringed planchet, counted in a proportional counter, and concentrations of gross alpha are calculated.
Gross Beta		Sample is dispersed on a ringed planchet, counted in a proportional counter, and concentrations of gross beta are calculated.
Radium -226		Barium carrier is added to an acidified sample where radium is initially separated on lead sulfate then barium sulfate. Ra-226 is determined by emanation method.
Lead-210		Radiochemical determination by separating daughter product Bi-210 and assaying its beta activity in a low level gas proportional counter.
Polonium-210		Sample is plated on a copper disc from an acidified solution. The disc is analyzed using an alpha spectrometer.
Thorium-230		Radiochemical technique analyzes for alpha-emitting nuclides with an alpha spectrometer using isotope dilution methods.
Radon-222		Solid sample is sealed and heated for 28 days then counted.

COAL ANALYTICAL PROCEDURES

This section provides information on analytical procedures used to characterize coal burned at the utility. Demonstration Test #3 burned coal that is typically used at the Bailly Generating Station. The section on coal analysis is comprised of four elements which include general metals analyses, proximate analysis, ultimate analysis, and radioactivity.

Digestion for Metals Analyses

The digestion procedure for metals analyses of coal samples was carried out using ASTM D 3682 (7,8)[1]. This procedure was used to prepare samples for analysis by flame or graphite furnace atomic absorption spectroscopy. Certain exceptions did apply and modifications to the above method were carried out as necessary.

An air dried coal sample was ground to pass a 250 μm mesh screen and ignited first at 500°C then at 750°C. The ash was then blended with lithium tetraborate and fused at 1000°C. After fusing, the flux was dissolved in 5% HCl on a stirring hotplate, cooled, and diluted to a working volume. This solution was then analyzed for metals as specified in the methods listed below.

GENERAL METALS ANALYSIS

The analytical methodology summarized in the general metals section provides a brief description of the techniques used for major, minor, and trace elemental characterization of coal burned at Northern Indiana's Bailly Generating Station.

Table 2-9. Methods for General Metals Analyses of Coal

Parameter	Reference Method	Summary
Aluminum	ASTM D 3682 (10)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 309.2 nm.
Antimony	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 217.6 nm.
Arsenic	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by graphite furnace atomic absorption spectroscopy at 193.7 nm.
Barium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 553.6 nm.
Beryllium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 234.9 nm.
Boron	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute hydrochloric acid. Boron quantified by curcumin colorimetric procedure (EPA 212.3).
Cadmium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 309.2 nm.
Calcium	ASTM D 3682 (12)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 228.8 nm.
Carbonate	ASTM D 3174 (modified)[1]	Calculation based on the weight loss obtained from 700 to 950 °C.

Table 2-9. Methods for General Metals Analyses of Coal (con.)

Parameter	Reference Method	Summary
Chloride	ASTM D 4208[1]	Oxygen bomb combustion with absorption of the chloride in dilute sodium carbonate. Absorbing solution analyzed for chloride levels by ion selective electrode.
Chromium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 357.9nm.
Cobalt	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 240.7 nm.
Copper	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 324.8 nm.
Cyanide	Std. Method 4500-CN C,E[8]	Cyanide is evolved as hydrocyanic acid and collected in a sodium hydroxide scrubber. The solution is complexed with a pyridine reagent and measured colorimetrically.
Fluoride	ASTM D 3761[1]	Oxygen bomb combustion with absorption of the fluorine in dilute sodium hydroxide. Absorbing solution analyzed for fluoride levels by ion selective electrode.
Iron	ASTM D 3682 (11)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 248.3 nm.
Lead	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by flame atomic absorption spectroscopy at 283.3nm.

Table 2-9. Methods for General Metals Analyses of Coal (con.)

Parameter	Reference Method	Summary
Lithium	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by flame atomic absorption spectroscopy at 670.8 nm.
Magnesium	ASTM D 3682 (13)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 285.1 nm.
Manganese	ASTM D 3682 (17)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 279.5 nm.
Mercury	ASTM D 3684[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Quantified by flameless cold vapor atomic absorption technique.
Molybdenum	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by flame atomic absorption spectroscopy at 313.3 nm.
Nickel	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 232.0 nm.
Nitrate	EPA Method 352.1[4]	A water soluble digestion is followed by filtration. The extract is acidified, reacted with brucine sulfate, and placed in a hot water bath. Absorption of the resulting color complex is measured by a spectrophotometer.
Potassium	ASTM D 3682 (15)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 766.5 nm.

Table 2-9. Methods for General Metals Analyses of Coal (con.)

Parameter	Reference Method	Summary
Selenium	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by graphite furnace atomic absorption spectroscopy at 196.0 nm.
Silicon	ASTM D 3682 (9)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 251.6 nm.
Silver	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by flame atomic absorption spectroscopy at 328.1 nm.
Sodium	ASTM D 3682 (14)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 589.0 nm.
Sulfate	ASTM D 2492 (6)[1]	Sulfate sulfur is extracted with HCl and determined gravimetrically by precipitation as barium sulfate.
Sulfide	ASTM D 2492 (7)[1]	Pyritic sulfur is digested with nitric acid from the residue remaining after the sulfate extraction. Iron in solution is measured by FAAS and sulfide is calculated as a stoicheometric combination with iron.
Sulfite	EPRI Method 40 (modified)[7]	A water soluble extraction is followed by filtration. Sample is added to a known amount of excess iodine solution and buffered with sodium acetate. A back-titrated with sodium thiosulfate determines sulfite levels.
Tin	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by graphite furnace absorption spectroscopy at 286.3 nm.

Table 2-9. Methods for General Metals Analyses of Coal (con.)

Parameter	Reference Method	Summary
Titanium	ASTM D 3682 (16)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 364.3 nm.
Uranium		Radiochemical technique analyzes for alpha-emitting nuclides with an alpha spectrometer using isotope dilution methods.
Vanadium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 318.0 nm.
Zinc	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 213.9 nm

PROXIMATE ANALYSIS

The proximate analysis (ASTM D 3172)[1] provides basic comparative information for evaluating types of coals.

Table 2-10. Methods for Coal Proximate Analysis

Parameter	Reference Method	Summary
Moisture	ASTM D 3173[1]	Weight loss percent obtained from oven drying at 104 - 110°C.
Ash	ASTM D 3174[1]	Weight percent of residue remaining after ignition at 700 - 750°C.
Volatile Matter	ASTM D 3175[1]	Weight loss percent, corrected for moisture content, obtained from heating to 950°C.
Fixed Carbon	ASTM D 3172 (6.4)[1]	Calculation obtained from the summation of moisture content, ash, and volatile matter percentages subtracted from 100 %.
BTU / LB (as received)	ASTM D 3286[1]	Calorific value is computed from temperature data obtained from the combustion of the sample in an oxygen bomb calorimeter.
BTU / LB (dry basis)	ASTM D 3180 (3.1.3)[1]	Calculated expresses result with no moisture associated with the sample.

ULTIMATE ANALYSIS

The ultimate analysis (ASTM D 3176)[1] also provides basic information applicable to the coal industry and is often reported in conjunction with the proximate analysis. The LECO® CHN analyzer referenced in the following table is an instrument that is capable of providing quick, accurate, and efficient turnaround for carbon, hydrogen, and nitrogen determinations.

Table 2-11. Methods for Coal Ultimate Analysis

Parameter	Reference Method	Summary
Ash	ASTM D 3174[1]	Weight percent of residue remaining after ignition at 700 - 750°C.
Hydrogen	LECO-CHN analyzer	Sample is combusted at 1000°C in an oxygen atmosphere. The products of combustion are swept through an infrared cell where the detection of hydrogen as H_2O takes place.
Carbon	LECO-CHN analyzer	Sample is combusted at 1000°C in an oxygen atmosphere. The products of combustion are swept through an infrared cell where the detection of carbon as CO_2 takes place.
Nitrogen	LECO-CHN analyzer	Sample is combusted at 1000°C in an oxygen atmosphere. The products of combustion are swept through a thermal conductivity cell where the detection of nitrogen takes place.
Sulfur	ASTM D 4239 Method C[1]	Sample is combusted in oxygen at 1350 °C where sulfur is converted to SO_2. The gases pass through multiple conditioning traps and into an infrared detector where SO_2 is measured.
Oxygen	ASTM D 3176 (6.5)[1]	Calculation based on the summation of the components of the ultimate analysis subtracted from 100 %.
Chloride	ASTM D 4208[1]	Oxygen bomb combustion with absorption of the chloride in dilute sodium carbonate. Absorbing solution analyzed for chloride levels by ion selective electrode.

FLY ASH ANALYTICAL PROCEDURES

This section provides information on analytical procedures used to characterize fly ash obtained from the Bailly Generating Station. The fly ash evaluated was from coal burned during Demonstration Test #3 which is of typical sulfur content used at the utility. This section on fly ash analysis is comprised of four elements which include general metals analyses, particle size distribution, hazardous waste classification, and radioactivity.

Digestion for Metals Analyses

The digestion procedure for metals analyses of fly ash samples was carried out using ASTM D 3682 (7,8)[1]. This procedure was used to prepare samples for analysis by flame or graphite furnace atomic absorption spectroscopy. Certain exceptions did apply and modifications to the above method were carried out as necessary.

Air dried fly ash sample was ground to pass a 250 µm mesh screen and ignited first at 500°C then at 750°C. The ash was then blended with lithium tetraborate and fused at 1000°C. After fusing, the flux was dissolved in 5% HCl on a stirring hotplate, cooled, and diluted to a working volume. This solution was then analyzed for metals as specified in the methods listed below.

GENERAL METALS ANALYSIS

The analytical methodology summarized in the general metals section provides a brief description of the techniques used for major, minor, and trace elemental characterization of fly ash obtained from Northern Indiana's Bailly Generating Station.

Table 2-13. Methods for General Metals Analyses of Fly Ash

Parameter	Reference Method	Summary
Aluminum	ASTM D 3682 (10)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 309.2 nm.
Antimony	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 217.6 nm.
Arsenic	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by graphite furnace atomic absorption spectroscopy at 193.7 nm.
Barium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 553.6 nm.
Beryllium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 234.9 nm.
Boron	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute hydrochloric acid. Boron quantified by curcumin colorimetric procedure (EPA 212.3).
Cadmium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 309.2 nm.
Calcium	ASTM D 3682 (12)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 228.8 nm.
Calcium Chloride	See Instrumental Procedure Section.	X-Ray Diffraction.

Table 2-13. Methods for General Metals Analyses of Fly Ash (con.)

Parameter	Reference Method	Summary
Calcium Fluoride	See Instrumental Procedure Section.	X-Ray Diffraction.
Calcium Hydroxide	See Instrumental Procedure Section.	X-Ray Diffraction.
Calcium Sulfate Dihydrate	See Instrumental Procedure Section.	X-Ray Diffraction.
Carbonate	ASTM D 3174 (modified)[1]	Calculation based on the weight loss obtained from 700 to 950 °C.
Chloride	ASTM D 4208[1]	Oxygen bomb combustion with absorption of the chloride in dilute sodium carbonate. Absorbing solution analyzed for chloride levels by ion selective electrode.
Chromium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 357.9nm.
Cobalt	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 240.7 nm.
Copper	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 324.8 nm.
Cyanide	Std. Method 4500-CN C,E[8]	Cyanide is evolved as hydrocyanic acid and collected in a sodium hydroxide scrubber. The solution is complexed with a pyridine reagent and measured colorimetrically.
Fluoride	ASTM D 3761[1]	Oxygen bomb combustion with absorption of the fluorine in dilute sodium hydroxide. Absorbing solution analyzed for fluoride levels by ion selective electrode.

Table 2-13. Methods for General Metals Analyses of Fly Ash (con.)

Parameter	Reference Method	Summary
Iron	ASTM D 3682 (11)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 248.3 nm.
Lead	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by flame atomic absorption spectroscopy at 283.3nm.
Lithium	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by flame atomic absorption spectroscopy at 670.8 nm.
Magnesium	ASTM D 3682 (13)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 285.1 nm.
Magnesium Chloride	See Instrumental Procedure Section.	X-Ray Diffraction.
Manganese	ASTM D 3682 (17)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 279.5 nm.
Mercury	ASTM D 3684[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Quantified by flameless cold vapor atomic absorption technique.
Molybdenum	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by flame atomic absorption spectroscopy at 313.3 nm.
Nickel	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 232.0 nm.

Table 2-13. Methods for General Metals Analyses of Fly Ash (con.)

Parameter	Reference Method	Summary
Nitrate	EPA Method 352.1[4]	A water soluble digestion is followed by filtration. The extract is acidified, reacted with brucine sulfate, and placed in a hot water bath. Absorption of the resulting color complex is measured by a spectrophotometer.
Potassium	ASTM D 3682 (15)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 766.5 nm.
Selenium	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by graphite furnace atomic absorption spectroscopy at 196.0 nm.
Silicon	ASTM D 3682 (9)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 251.6 nm.
Silver	ASTM D 3684 (digestion only)[1]	Oxygen bomb combustion with absorption in dilute nitric acid. Analyzed by flame atomic absorption spectroscopy at 328.1 nm.
Sodium	ASTM D 3682 (14)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 589.0 nm.
Sulfate	ASTM D 2492 (6)[1]	Sulfate sulfur is extracted with HCl and determined gravimetrically by precipitation as barium sulfate.
	ASTM C 114 (15.1)[2]	Sample is digested in HCl and the sulfate is precipitated with barium chloride. The sample is filtered, dried, and ignited. Gravimetric determination is based on recovery of barium sulfate.

Table 2-13. Methods for General Metals Analyses of Fly Ash (con.)

Parameter	Reference Method	Summary
Sulfide	ASTM D 2492 (7)[1]	Pyritic sulfur is digested with nitric acid from the residue remaining after the sulfate extraction. Iron in solution is measured by FAAS and sulfide is calculated as a stoicheometric combination with iron.
Sulfite	EPRI Method 40 (modified)[7]	A water soluble extraction is followed by filtration. Sample is added to a known amount of excess iodine solution and buffered with sodium acetate. A back-titrated with sodium thiosulfate determines sulfite levels.
Tin	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by graphite furnace absorption spectroscopy at 286.3 nm.
Titanium	ASTM D 3682 (16)[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 364.3 nm.
Uranium		Radiochemical technique analyzes for alpha-emitting nuclides with an alpha spectrometer using isotope dilution methods.
Vanadium	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 318.0 nm.
Zinc	ASTM D 3682[1]	Sample is ignited, fused with lithium tetraborate, and dissolved in HCl. Analysis performed by atomic absorption spectroscopy at 213.9 nm.

TCLP METHODS

The TCLP methods employed for fly ash characterization were designed to determine the mobility of inorganic analytes present in this solid waste. EPA SW-846 Method 1311 outlines the procedures which are required to prepare the sample for analysis. The solid waste is extracted with acetic acid or an acetic acid / sodium hydroxide solution depending on the pH of the solid phase. The 20:1 extraction takes place over a period of 18 hrs. on a rotary agitator. The slurry is filtered and the filtrate is defined as the TCLP extract. This extract is used as the sample in the analytical procedures listed below.

Table 2-14. Fly Ash TCLP Analytical Methods

Parameter	Reference Method	Summary
Silver	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 328.068 nm.
Arsenic	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 193.696 nm.
Barium	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 455.403 nm.
Cadmium	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 226.502 nm.
Corrosivity-pH	EPA SW-846 Method 9045[3]	An electrochemical procedure which measures the pH of the supernatant portion of a 1:1 dispersion of a sample in high purity water.
Chromium	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 267.716nm.

Table 2-14. Fly Ash TCLP Analytical Methods (con.)

Parameter	Reference Method	Summary
Mercury	EPA SW-846 Method 7470[3]	Mercury is reduced to the elemental form and is aerated from solution. The vapor passes through a closed system and into the light path of an AA spectrophotometer. Absorbance is measured at 253.7 nm. as a function of concentration.
Ignitability	40 CFR 261.21[5]	Vigorous and persistent burning when sample is ignited.
Lead	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 220.353 nm.
Reactive Cyanide	EPA SW-846 Method 9010[3]	Cyanide is evolved as hydrocyanic acid and collected in a sodium hydroxide scrubber. The solution is complexed with a pyridine reagent and measured colorimetrically.
Reactive Sulfide	EPA SW-846 Method 9030[3]	Sample is pretreated with zinc acetate. Hydrogen sulfide is evolved through acidification in a closed system. Analysis is performed using an iodine sodium-thiosulfate back titration.
Selenium	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy measured at a wavelength of 196.026 nm.
Total Solids	Std. Method 209 F[9]	Solid samples are dried to a constant weight at 103-105 ^{o}C.

INDIANA NEUTRAL LEACHATE TEST

The purpose of The Indiana Neutral Leachate Test (INLT) test is to provide further characterization of the waste stream for waste classification purposes. The Indiana Department of Environmental Management has identified maximum permissible levels for certain water soluble constituents which may be present in the waste stream. The INLT sample preparation procedure is identical to that of the TCLP Method 1311 except for the type of fluid used in the extraction process. Deionized water is substituted for the acetic acid solutions that are used in the TCLP extraction. All other procedures found in Method 1311 are carried out. This extract is then subjected to the following analytical procedures.

Table 2-15. Indiana Neutral Leachate Methods for Fly Ash

Parameter	Reference Method	Summary
Barium	EPA SW-846 Method 7080[3]	Atomic absorption spectroscopy at 553.6 nm. with a nitrous oxide/ acetylene flame and KCl as an ionization suppressant.
Boron	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 249.773 nm.
Chloride	Std. Method 407 B[9]	Mercuric nitrate titration. Chloride is titrated with mercuric nitrate to form a soluble, slightly dissociated mercuric chloride. Endpoint is determined by a purple complex resulting from the presence of diphenylcarbazone with excess mercuric ions.
Copper	EPA SW-846 Method 7210[3]	Atomic absorption spectroscopy at 324.7 nm. with a lean oxidizing flame.
Cyanide (Amenable)	EPA Method 335.1[4]	Sample is chlorinated at pH > 11 to decompose cyanide. EPA Method 335.2 (total cyanide) is then used for the determination.

Table 2-15. Indiana Neutral Leachate Methods for Fly Ash (con.)

Parameter	Reference Method	Summary
Cyanide (Total)	EPA Method 335.2[4]	Cyanide is evolved as hydrocyanic acid and collected in a sodium hydroxide scrubber. The solution is either titrated with silver nitrate or complexed with a pyridine reagent and measured colorimetrically.
Fluoride	EPA method 340.1[4]	Sample is distilled and the fluoride is reacted with a SPADNS reagent. Loss of color is measured colorimetrically and is a function of fluoride level.
Iron	EPA SW-846 Method 7380[3]	Atomic absorption spectroscopy at 248.3 nm. with a lean oxidizing flame and background correction.
Manganese	EPA SW-846 Method 7460[3]	Atomic absorption spectroscopy at 279.5 nm. with a lean oxidizing flame and background correction.
Nickel	EPA SW-846 Method 7520[3]	Atomic absorption spectroscopy at 232.0 nm. with a lean oxidizing flame and background correction.
pH	EPA Method 150.1[4]	Hydrogen ion activity is measured potentiometrically using a glass and reference electrode.
Phenolics (Total)	EPA Method 420.1[4]	Formation of a red-brown anti-pyrine dye is measured colorimetrically and the color produced is a function of phenolic material.
Sodium	EPA SW-846 Method 7770[3]	Atomic absorption spectroscopy at 589.6 nm. with a lean oxidizing flame. The use of an ionization suppressant is recommended.
Sulfate	EPA Method 375.4[4]	Turbidimetric method reacts sample with barium chloride to precipitate barium sulfate. Absorbance is measured with a spectrophotometer and plotted on a calibration curve of known sulfate standards.

Table 2-15. Indiana Neutral Leachate Methods for Fly Ash (con.)

Parameter	Reference Method	Summary
Sulfides (Total)	Std. Method 427 C[9]	Sulfide, ferric chloride, and dimethyl-p-phenylenediamine are reacted to produce methyene blue. Ammonium phosphate is added to remove color due to ferric chloride. Absorbance is measured with a spectrophotometer.
TDS	EPA Method 160.1[4]	Sample is filtered through a glass fiber filter. The filtrate is evaporated and dried to a constant weight at 180 ^{o}C.
Zinc	EPA SW-846 Method 7950[3]	Atomic absorption spectroscopy at 213.9 nm. with a lean oxidizing flame and background correction.

RADIOACTIVITY

Fly ash radioactivity parameters itemized in Table 2-16 were evaluated to address potential environmental concerns. Teledyne Isotopes, a reputable contract laboratory providing analytical services in the field of radioactivity, performed the studies on the fly ash produced at the NIPSCO Bailly Generating Station.

Table 2-16. Radioactivity Methods for Fly Ash

Parameter	Reference Method	Summary
Gross Alpha		Sample is dispersed on a ringed planchet, counted in a proportional counter, and concentrations of gross alpha are calculated.
Gross Beta		Sample is dispersed on a ringed planchet, counted in a proportional counter, and concentrations of gross beta are calculated.
Radium -226		Barium carrier is added to an acidified sample where radium is initially separated on lead sulfate then barium sulfate. Ra-226 is determined by emanation method.
Lead-210		Radiochemical determination by separating daughter product Bi-210 and assaying its beta activity in a low level gas proportional counter.
Polonium-210		Sample is plated on a copper disc from an acidified solution. The disc is analyzed using an alpha spectrometer.
Thorium-230		Radiochemical technique analyzes for alpha-emitting nuclides with an alpha spectrometer using isotope dilution methods.
Radon-222		Solid sample is sealed and heated for 28 days then counted.

Table 2-17. Methods for General Metals Analyses of Process Water (con.)

Parameter	Reference Method	Summary
Lithium	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 670.78 nm.
Magnesium	EPA Method 242.1[4]	Atomic absorption spectroscopy at 285.2 nm. using an oxidizing flame and the addition of lanthanum chloride.
Manganese	EPA Method 243.1[4]	Atomic absorption spectroscopy at 279.5 nm. with a lean oxidizing flame and background correction.
Mercury	EPA Method 245.1[4]	Flameless atomic absorption at 253.7 nm. Absorbance is measured as a function of mercury concentration as the vapor passes through the light path of a spectrometer.
Molybdenum	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy at 202.03 nm.
Nickel	EPA Method 249.1[4]	Flame AA analysis with an oxidizing air-acetylene flame at 232.0 nm. and background correction.
Nitrate	EPA Method 353.3[4]	Samples containing nitrate and nitrite are reduced to nitrite by passing the sample through a column containing copper-cadmium. The nitrite forms a highly colored dye after diazotizing with sulfanilamide and reacting with N-(1-napthyl)-ethylenediamine dihydrochloride. Nitrate is determined by difference after carrying out the above procedure without the copper-cadmium reduction process.
Oil and Grease	EPA Method 413.1[4]	An acidified sample is extracted with fluorocarbon-113. The residue is weighed after the solvent is evaporated from the extract.
pH	EPA Method 150.1[4]	Hydrogen ion activity is measured potentiometrically using a glass and reference electrode.

Table 2-17. Methods for General Metals Analyses of Process Water (con.)

Parameter	Reference Method	Summary
Potassium	EPA Method 258.1[4]	Atomic absorption spectroscopy at 766.5 nm. using a slightly oxidizing flame. The use of an ionization suppressant is suggested.
Selenium	EPA Method 270.2[4]	Graphite furnace atomic absorption spectroscopy at 196.0 nm. The use of nickel nitrate as a matrix modifier and background correction should be incorporated.
Silicon	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 228.158 nm.
Silver	EPA Method 272.1[4]	Flame AA analysis at 328.1 nm with an air-acetylene flame. Sample must be digested in nitric rather than HCl to prevent precipitation of silver chloride.
Sodium	EPA Method 273.1[4]	Atomic absorption spectroscopy at 589.6 nm. with a lean oxidizing flame. The use of an ionization suppressant is recommended.
Sulfate	EPA Method 375.4[4]	Turbidimetric method reacts sample with barium chloride to precipitate barium sulfate. Absorbance is measured with a spectrophotometer and plotted on a calibration curve of known sulfate standards.
Sulfite	EPRI Method 40[7]	Sample is added to a known amount of excess iodine solution, acidified, and in the presence of starch, back-titrated with sodium thiosulfate.
Sulfide	Std. Method 427 C[9]	Sulfide, ferric chloride, and dimethyl-p-phenylenediamine are reacted to produce methyene blue. Ammonium phosphate is added to remove color due to ferric chloride. Absorbance is measured with a spectrophotometer.

Table 2-17. Methods for General Metals Analyses of Process Water (con.)

Parameter	Reference Method	Summary
Tin	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 189.99 nm.
TSS	EPA Method 160.2[4]	Sample is filtered through a glass fiber filter. The residue and filter are dried to a constant weight at 103-105 °C.
TDS	EPA Method 160.1[4]	Sample is filtered through a glass fiber filter. The filtrate is evaporated and dried to a constant weight at 180 °C.
Titanium	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 334.94 nm.
Uranium	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 385.96 nm.
Vanadium	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 292.402 nm.
Zinc	EPA Method 289.1[4]	Atomic absorption spectroscopy at 213.9 nm. with a lean oxidizing flame and background correction.

WASTE WATER INFLUENT / EFFLUENT ANALYTICAL PROCEDURES

This section provides information on analytical procedures used to characterize wastewater influent and effluent obtained from the Bailly FGD wastewater treatment plant. Wastewater influent was collected before entering into the neutralization tank of the treatment facility. Effluent was composite sampled prior to entering into the main outfall of the utility.

Digestion for Metals Analyses

The digestion procedures for metals analyses of wastewater samples were carried out according to the EPA procedures[4] identified with each specific analytical method. Reference to part 4.1 of the atomic absorption methods is mentioned for those analyses conducted by AA techniques. These procedures were used to prepare samples for analysis by flame/graphite furnace atomic absorption spectroscopy and inductively coupled plasma atomic emission spectroscopy.

GENERAL METALS ANALYSIS

The analytical methodology summarized in the general metals section provides a brief description of the techniques for trace elemental characterization of wastewater samples obtained from the Bailly FGD wastewater treatment facility.

Table 2-18. Methods for General Metals Analyses of Wastewater

Parameter	Reference Method	Summary
Aluminum	EPA Method 202.1[4]	Atomic absorption spectroscopy at 309.3 nm. using a nitrous oxide-acetylene flame. KCl is added to prevent ionization.
Antimony	EPA Method 204.2[4]	Graphite furnace analysis at 217.6 nm using background correction. Ammonium nitrate used for controlling chloride interference.
Arsenic	EPA Method 206.2[4]	Graphite furnace analysis at 193.7 nm with background correction. Nickel nitrate is used as a matrix modifier.
Barium	EPA Method 208.1[4]	Flame atomic absorption analysis at 553.6 nm with a nitrous oxide-acetylene fuel rich flame. KCl is added as an ionization suppressant.
Beryllium	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 313.042 nm.
Boron	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 249.773 nm.
Cadmium	EPA Method 213.1[4]	Atomic absorption spectroscopy at 228.8 nm. with an oxidizing flame.
Calcium	EPA Method 215.1[4]	Atomic absorption spectroscopy at 422.7 nm using a nitrous oxide-acetylene flame. Lanthanum nitrate is used to control chemical interferences.
Chloride	Std. Method 407 B[9]	Mercuric nitrate titration. Chloride is titrated with mercuric nitrate to form a soluble, slightly dissociated mercuric chloride. Endpoint is determined by a purple complex resulting from the presence of diphenylcarbazone with excess mercuric ions.

Table 2-18. Methods for General Metals Analyses of Wastewater (con.)

Parameter	Reference Method	Summary
Chromium	EPA Method 218.1[4]	Flame atomic absorption analysis at 347.9 nm with a nitrous oxide-acetylene fuel rich flame.
Cobalt	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 228.616 nm.
Copper	EPA Method 220.1[4]	Atomic absorption spectroscopy at 324.7 nm. with a lean oxidizing flame.
Cyanide	EPA Method 335.2[4]	Cyanide is evolved as hydrocyanic acid and collected in a sodium hydroxide scrubber. The solution is either titrated with silver nitrate or complexed with a pyridine reagent and measured colorimetrically.
Fluoride	EPA Method 340.1[4]	Sample is distilled and the fluoride is reacted with a SPADNS reagent. Loss of color is measured colorimetrically and is a function of fluoride level.
Flow		Magnetic flow meter.
Iron	EPA Method 236.1[4]	Atomic absorption spectroscopy at 248.3 nm. with a lean oxidizing flame and background correction.
Lead	EPA Method 239.2[4]	Graphite furnace atomic absorption spectroscopy at 283.3 nm. Lanthanum added to suppress sulfate interference. Background correction recommended.
Lithium	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 670.78 nm..
Magnesium	EPA Method 242.1[4]	Atomic absorption spectroscopy at 285.2 nm. using an oxidizing flame and the addition of lanthanum chloride.
Manganese	EPA Method 243.1[4]	Atomic absorption spectroscopy at 279.5 nm. with a lean oxidizing flame and background correction.

Table 2-18. Methods for General Metals Analyses of Wastewater (con.)

Parameter	Reference Method	Summary
Mercury	EPA Method 245.1[4]	Flameless atomic absorption at 253.7 nm. Absorbance is measured as a function of mercury concentration as the vapor passes through the light path of a spectrometer.
Molybdenum	EPA SW-846 Method 6010[3]	Inductively coupled plasma atomic emission spectroscopy at 202.03 nm.
Nickel	EPA Method 249.1[4]	Flame AA analysis with an oxidizing air-acetylene flame at 232.0 nm. and background correction.
Oil and Grease	EPA Method 413.1[4]	An acidified sample is extracted with fluorocarbon-113. Residue is weighed after the solvent is evaporated from the extract.
pH	EPA Method 150.1[4]	Hydrogen ion activity is measured potentiometrically using a glass and reference electrode.
Potassium	EPA Method 258.1[4]	Atomic absorption spectroscopy at 766.5 nm. using a slightly oxidizing flame. The use of an ionization suppressant is suggested.
Selenium	EPA Method 270.2[4]	Graphite furnace atomic absorption spectroscopy at 196.0 nm. The use of nickel nitrate as a matrix modifier and background correction should be incorporated.
Silver	EPA Method 272.1[4]	Flame AA analysis at 328.1 nm with an air-acetylene flame. Sample must be digested in nitric rather than HCl to prevent precipitation of silver chloride.
Sodium	EPA Method 273.1[4]	Atomic absorption spectroscopy.

Table 2-18. Methods for General Metals Analyses of Wastewater (con.)

Parameter	Reference Method	Summary
Sulfate	EPA Method 375.4[4]	Turbidimetric method reacts sample with barium chloride to precipitate barium sulfate. Absorbance is measured with a spectrophotometer and plotted on a calibration curve of known sulfate standards.
Sulfide	Std. Method 427 C[9]	Sulfide, ferric chloride, and dimethyl-p-phenylenediamine are reacted to produce methyene blue. Ammonium phosphate is added to remove color due to ferric chloride. Absorbance is measured with a spectrophotometer.
Tin	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 189.99 nm.
TSS	EPA Method 160.2[4]	Sample is filtered through a glass fiber filter. The residue and filter are dried to a constant weight at 103-105 °C.
TDS	EPA Method 160.1[4]	Sample is filtered through a glass fiber filter. The filtrate is evaporated and dried to a constant weight at 180 °C.
Titanium	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 334.94 nm.
Uranium	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 385.96 nm.
Vanadium	EPA Method 200.7[4]	Inductively coupled plasma atomic emission spectroscopy at 292.402 nm.
Zinc	EPA Method 289.1[4]	Atomic absorption spectroscopy at 213.9 nm. with a lean oxidizing flame and background correction.

SECTION 6.2.3

LABORATORY OPERATIONS

The Bailly FGD laboratory is assigned with the prime responsibility of acquiring and reporting physical and chemical data which is critical to the operation of the FGD unit. Aside of the daily reporting of routine process data, personnel are also charged with other responsibilities associated with laboratory and plant operations. A sample of these tasks include:

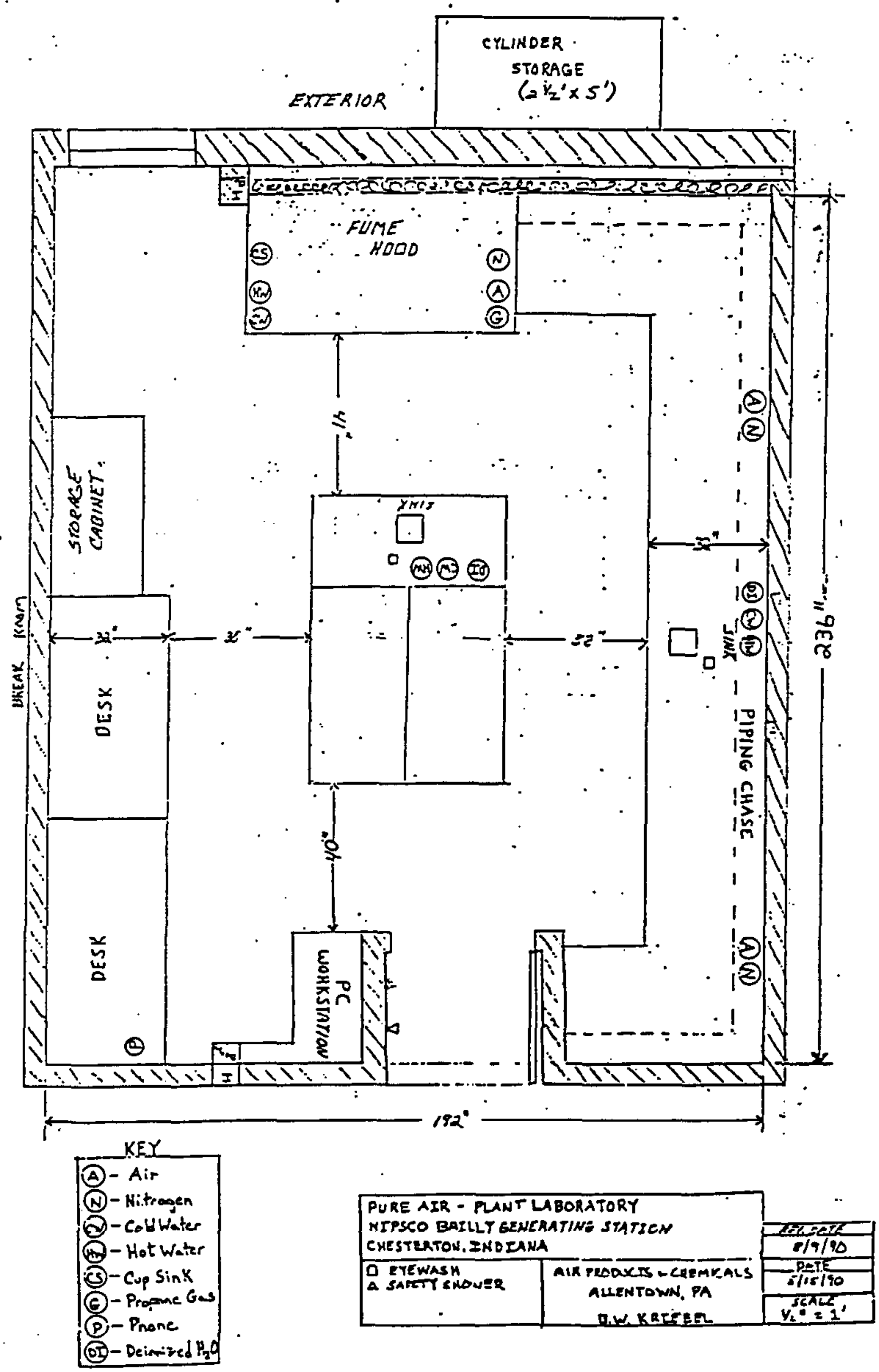
- data entry and analysis
- statistical process and quality control
- laboratory quality assurance and safety
- process analyzer maintenance and calibration
- perform non-routine analyses
- laboratory training of operations personnel
- laboratory maintenance
- report writing

LABORATORY LAYOUT, EQUIPMENT, AND SUPPLIES

The Bailly FGD laboratory is a 320 sq. ft. facility providing space to accommodate two lab personnel. The air conditioned lab is located on the first floor of the administration building adjacent to the control room. A remote supply area allows for the storage of consumable items such as polyethylene bottles as well as infrequently used equipment which would otherwise occupy valuable laboratory space.

A floor plan of the laboratory is provided in Figure 3-1. The size of the lab and the scope of its operations were designed to provide routine daily monitoring of FGD system performance. Increased sample loads and non-routine analyses occurring as a result of test plan monitoring require the support of additional technical personnel and contract lab resources.

Figure 3-1. FGD Laboratory Floor Plan



The lab is configured with a variety of floor mounted base cabinets which support Kemresin® bench tops. Wall mounted cabinets with glass doors are provided for additional storage space. In addition to the main laboratory furniture, the facility is also equipped with the following items:

- fume hood - auxiliary air type with corrosion resistant components
- acid and flammable storage cabinets
- central deionized water system
- 100 amp electrical service (ground faulted)
- lab bench utilities (water, nitrogen, propane gas1, compressed air, vacuum)
- two sinks with eyewash stations
- safety shower
- refrigerator
- sample storage cabinet
- computer workstation
- two technician desks

A list of analytical equipment required for operation of the FGD lab can be found in Table 3-1. The equipment listed in this table is typical of that found in a wet inorganic chemistry lab and will support the process stream analytical methodology summarized in Table 2-6. The lab is also equipped with a microprocessor controlled infrared moisture analyzer capable of providing rapid two-step loss on drying results. Applications for free and combined water determinations on gypsum by-product have been developed using this instrument.

Table 3-2 contains a list of reagent grade chemicals which are required to carry out the analytical test procedures cited in Table 2-6. The purity of the chemical purchased is dictated by the type of analysis in which it is to be used. A reagent used for sample preparation for trace elemental analysis should be of significantly higher purity then one required for general bulk characterization. Products labeled *"Meets ACS Specifications"* or the like are recommended.

Table 3-1. Analytical Instrumentation and Accessories

Analytical Balance, Mettler AT200	Muffle Furnace, Thermolyne F48025-70
Blaine Air Permeability Apparatus	Oven, Thermolyne 2.9 ft3
DI Cartdige Kit, NANOpure, D4801	Pan Balance, Mettler PM6100
Chloride ISE, ORION	pH Meter, ORION Portable w/ start kit
Conductivity/TDS Meter Kit, ORION 124	pH/ISE Meter, ORION EA940
Dessicator	Sampler, Riffle Type ASTM D271
Electrode pH, Std. Sure-Flow Glass	Sieve Shaker w/Timer,CSC
Electrode, Reference Double Junction	Spectrophotometer, Spectronic 21
Electrode, Reference Single Junction	Stirrer, Caframo RZR1
Electrose pH, Std. Sure-Flow Epoxy	Stirrer, Corning 35 in2
Fluoride ISE, ORION 9409BN	Stirrer, Lighted, Thermolyne
Hot Plate, Corning 100 in2	Vacuum Pump, Gast 4 cfm
Hot Plate/Stirrer, Corning 35 in2	Water Bath, VWR 1235PC, Medium
Moisture Analyzer, LOD, ORION Model II	DI Water System, NANOpure, D4741

General laboratory glassware and supplies are itemized in Tables 3-3 and 3-4, respectively. This inventory of consumables and analytical accessories is standard protocol for a chemistry laboratory. Glassware purchased for use in the Bailly lab is of the high quality type and rated "Class A", where applicable.

Appendix B contains a list of vendors who were selected to supply laboratory furniture, analytical instrumentation, chemical reagents, and other laboratory products to equip the Bailly FGD laboratory for operation.

LAB PERSONNEL

An analytical chemist with a technical discipline in atomic spectroscopy and wet inorganic chemistry was assigned to the project to provide technical support for the start-up and demonstration testing of the Bailly FGD unit. This individual has been charged with overseeing all aspects of laboratory planning and operations which included:

- coordinating all functions associated with the design and construction of the FGD laboratory
- specifying and procuring analytical instrumentation and laboratory supplies
- determining manpower requirements and training laboratory staff
- selecting and validating analytical test methods
- implementing a contract lab evaluation program
- directing analytical testing activities and providing technical support

A technician routinely staffs the FGD laboratory with direction from the plant manager. This individual is responsible for the day to day operations of the plant laboratory. The technician has two years of college training in chemistry and has six years of previous experience in plant labs. The technician's hands-on laboratory experience include wet inorganic chemistry techniques and atomic absorption spectroscopy. The individual is also acquainted with formal analytical methodology, general laboratory practices, and QA/QC procedures.

Table 3-3. General Laboratory Glassware

- Adapter, Optifix 38 mm Teflon
- Beaker, 150 ml
- Beaker, 250 ml
- Beaker, 400 ml
- Beaker, 50 ml
- Beaker, 600 ml
- Beaker, Heatable 100 ml
- Beaker, PMP Nalgene 1000 ml
- Beaker, PMP Nalgene 2000 ml
- Beaker, Teflon 150 ml
- Bottle, Polypropylene, 4 L
- Bottles, Dropping LDPE, 60 ml.
- Buret, Automatic 25 ml
- Buret, Automatic 50 ml
- Buret, KIMAX, 25 ml
- Buret, KIMAX, 50 ml
- Buret, Micro Auto, 10 ml
- Condensor, 220 ml spherical
  w/ side stopcock
- Dispenser, Optifix 10 ml
- Dispenser, Precise-Volume, 1 ml.
- Dispenser, Precise-Volume, 2 ml.
- Dispenser, Precise-Volume, 5 ml.
- Dispenser, Variable-Volume, 25 ml.
- Dropping Bottle, Amber 2 oz.
- Erlenmeyer Flask w/ Stopper, 25 ml
- Erlenmeyer Flask, 500 ml
- Erlenmeyer Flasks, 125 ml
- Erlenmeyer Flasks, 250 ml
- Erlenmeyer Flasks, 500 ml
- Filling/Venting Closure, 83 mm.
- Filter Funnel, Buchner 126 mm.
- Filter Funnel, Buchner 253 mm.
- Filter Funnel, Buchner 83 mm.
- Flask,170 ml round bottom
  w/ side distillation tube
- Funnel, 60ml dropping
- Filter Holder, Nalgene 500/500 ml
- Filter Flask, Nalgene PP 1000 ml
- Filter Flask, Nalgene PP 500 ml
- Filtration Flasks, 250 ml
- Filtration Flasks, 500 ml
- Funnel, Polyprop 114 ml.
- Funnel, Polyprop 254 ml.
- Funnel, Polyprop 41 ml.
- Funnel, Powder 104 mm.
- Funnel, Powder 65 mm.
- Gas Wash Bottle, 250 ml.
- Glass Tube, 3 in.
- Grad Cylinder, PMP Nalgene 10 ml
- Grad Cylinder, PMP Nalgene 100 ml
- Grad Cylinder, PMP Nalgene 25 ml
- Grad Cylinder, PMP Nalgene 250 ml
- Grad Cylinder, PMP Nalgene 50 ml
- Grad Cylinder, PMP Nalgene 500 ml
- Graduated Cylinder, 10 ml
- Graduated Cylinder, 100 ml
- Graduated Cylinder, 25 ml
- Graduated Cylinder, 250 ml
- Graduated Cylinder, 50 ml
- Hydrometer, 1.000 - 1.050
- Hydrometer, 1.050 - 1.100
- Hydrometer, 1.100 - 1.150
- Hydrometer, 1.150 - 1.200
- Hydrometer, 1.200 - 1.250
- Hydrometer, 1.250 - 1.300
- Male Adapter, 1/4"
- Measuring Burret, 25 ml
- Pipet Filler, Black
- Pipet, Eppendorf 10-100 uL
- Pipet, Eppendorf 200-1000 uL
- Pipet, Nalgene 10 ml
- Pipet, Nalgene 5 ml
- Poly Bottle, 1000 ml HDPE
- Poly Bottle, 1000 ml LDPE
- Poly Bottle, 125 ml
- Poly Bottle, 250 ml HDPE
- Poly Bottle, 500 ml LDPE
- Poly Bottle, 60 ml
- Poly Bottle, Amber 1000 ml HDPE
- Poly Bottle, Amber 250 ml HDPE
- Poly Wide Mouth Bottle, 1 gal.
- Safety Bulb, Pipet
- Self-Zeroing Buret Kit
- Vol. Flask, PMP Nalgene 100 ml
- Vol. Flask, PMP Nalgene 50 ml
- Volumetric Flasks, 100 ml
- Volumetric Flasks, 1000 ml
- Volumetric Flasks, 25 ml
- Volumetric Flasks, 250 ml
- Volumetric Flasks, 50 ml
- Volumetric Flasks, 500 ml
- Volumetric Pipet, 1 ml
- Volumetric Pipet, 10 ml
- Volumetric Pipet, 2 ml
- Volumetric Pipet, 20 ml
- Volumetric Pipet, 25 ml
- Volumetric Pipet, 5 ml
- Volumetric Pipet, 50 ml
- Wash Bottle, 500 ml.
- Watch Glass, 75 mm.
- Watch Glass, 90 mm.
- Weigh Bottle, GlassStopper, 50x25
- Weigh Bottle, Glass Stopper, 80x40
- Dial Thermometer, 0 to 150 oC
- Thermometer, -10 to 260oC, Yellow
- Thermometer, -20 to 150oC, Yellow
- Thermometer, Water Bath

Table 3-4. General Lab Supplies

Brush, button	Gooch Crucible, Porcelain 25 ml	Sieve, Tyler 53 um
Burner, Meker Type	Lab Stand	Sieve, Tyler 600 um
Calibration Weights, Balance	Laboratory Gas Lighter	Sieve, Tyler 75 um
Clamp Assembly	Magnetic Stir Bar, 1 1/2 x 3/8	Sieve, Tyler150 um
Clamp Holder, 90 Degree	Magnetic Stir Bar, 1 x 3/8	Spatula, Double Blade
Clamp, Double Buret	Magnetic Stir Bar, 1/2 x 1 3/8	Spatula, Micro-Spoon
Clamp, Pinchcock, Large	Magnetic Stir Bar, 1/2 x 3/8	Spatula, Stainless Steel 5 in.
Clamp, Screw Compressor, Small	Magnetic Stir Bar, 2 x 3/8	Stir Bar Retriever
Clamp, Thermometer Extension	Magnetic Stir Bar, 5/8 x 7/8	Stirrer Paddle
Clamp, Three-Prong Large	Mortar & Pestle, Agate	Stirring Rod, Polyprop
Clamp, Three-Prong Medium	Mortar, Porcelain 115x70mm	Stirring Rod, Tefzel
Clamp, Three-Prong Small	Mortar, Porcelain 130x80mm	Stopcock Grease, Silicone
Clamps, Hose, Various size	Paddle, SS, 1/4"	Stopper, one hole
Connector, Tubing Straight	Parafilm, 4" x 250'	Stopper, one hole
Connector, Tubing Y-shaped	Pestle, Porcelain	Stopwatch, Digital
Covers, Platinum 30 ml	Pestle, Porcelain	Support Jack, Standard
Crucible Cover, Porcelain Size G	Pinch Clamp	Support Stand, PolyEth, Cntr. Rod
Crucible, Platinum 30 ml	Pluro Rubber Stoppers	Teflon Tubing
Crucibles, Porcelain 30ml.	Polyprop Scoops, 3.5 x 1.5	Tongs, Crucible, Stainless
Crucibles, Wide Porc, 150 ml.	Polyprop Scoops, 8 x 4.75	Tongs, Extended Jaw
Dish, Platinum 100 ml.	Rubber Policeman	Tongs, Safety
Dispenser, Parafilm	Rubber Stopper Assortment	Tongs, Teflon Tipped
Filter Paper, Ashless #40 24.0 cm	Rubber Tube, 1 ft.	Tygon Tubing, 1/4 x 1/16
Filter Paper, Ashless #40 7.0 cm	Sieve Cover	Weigh Paper, 3x3
Filter Paper, Ashless #40 11.0 cm.	Sieve, Bottom Pan	Weigh Paper, 6x6
Filter Paper, Ashless #40 12.5 cm.	Sieve, Tyler 1000 um	Weighing Boat, 3.5 x 5.25
Filter Paper, Glass 934-AH 7.0 cm	Sieve, Tyler 106 um	Weighing Dish, Aluminum, Dispos.
Forceps	Sieve, Tyler 300 um	Wipes, Staticide Towelettes
Gooch Cruc, Fritted M Disc 50 ml.	Sieve, Tyler 45 um	

The level of manpower and contract lab resources vary and are typically dictated by the types of demonstration test program activity taking place. A temporary lab technician has been retained at the Bailly lab since May '92 to provide additional laboratory support during peak periods of analytical testing. This individual has been educated at the bachelor degree level in industrial engineering and also has demonstrated experience in plant laboratory environments.

Operations technicians have been instructed in sample collection procedures as well as trained to execute a handful of analytical determinations such as density, combined water, and weight percent solids. They will typically perform analyses as deemed necessary when the lab is not staffed (night shift) with technical personnel .

QUALITY ASSURANCE

Training

Training of the permanent laboratory technician was performed by the chemist who was accountable for laboratory operations. The chemist has had previous experience with FGD chemistry systems in addition to the technical discipline in analytical chemistry. Training in FGD analytical testing protocol requires a fundamental understanding of laboratory procedures and wet chemistry techniques. The technician was exposed to a five month training period in which the individual could become familiarized with the concepts of FGD chemistry and system operation. This training took place prior to start-up of the FGD system and was held concurrently with method validation activity.

A formal training program for plant operations technicians (Op Techs) has been recently implemented. A manual of test methods containing simplified analytical procedures was prepared for use by these individuals. The Op Techs were then assigned to the FGD lab over a period of time for hands-on training. The objective of this program was to allow the Op Techs to carry out a limited number of test procedures when lab personnel are not present.

Recordkeeping

Samples are logged onto daily worksheets and report forms to ensure sample identity and integrity. Sample identification codes are assigned as per the procedures outlined Table 1-1. Raw data from analyses is recorded on worksheets and retained on file in the laboratory. Data output from instruments are recorded on the worksheet and become part of this record. Final laboratory results are reported on a standardized spreadsheet known as the "daily report form" (Figure 3-2). Internal and external analytical results are entered into a large database through the use of Microsoft® Excel. This database, which is set up on a local area network, allows personnel to evaluate process relationships and overall system performance. Hardcopies of the Excel spreadsheets are sorted by process stream and filed chronologically in binders.

Equipment calibration and maintenance records are documented in the lab QA/QC notebook. The types of instrumentation and frequency of calibration checks required for Bailly laboratory equipment are listed in Table 3-5. Other quality assurance records that are being maintained are:

- intralaboratory testing results
- control charts
- analytical test method summaries
- contract lab proficient testing results

Samples which are submitted to outside laboratories for analysis are recorded in a sample log book. The information documented in the sample log entry and on the label affixed to the sample container include:

- sample type
- sample location
- sample date and time
- sample log notebook number
- FGD sample identification code
- contract lab name and project manager
- requested analyses
- shipping priority
- sample preservation technique

FIGURE 3-2. FGD LAB DAILY ANALYTICAL REPORT FORM

DATE	TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO3 mmol/L	SO4 mmol/L	Cl ppm	F ppm	Al ppm	SiO2 ppm	Mn ppm	Fe ppm	MOISTURE wt. %	COMBINED WATER wt. %
ABSORBER	7:00 AM												1/WEEK	1/WEEK	1/WEEK	1/WEEK		
GYPSUM	7:00 AM												1/WEEK	1/WEEK	1/WEEK	1/WEEK		
FILTRATE SUMP	7:00 AM																	
THICKENER U/F	7:00 AM																	
THICKENER O/F	7:00 AM																	

Table 3-5. Bailly FGD Lab Equipment Calibration Schedule

Equipment Type	Instrument	Control Chart Parameter	Frequency
Analytical Balances	Mettler AT-200	calibration weights (10 mg - 50 g)	weekly
	Mettler PM 6100	cal. weights (5, 10, 30, 50, 2000, 4000 g)	weekly
	Orion LOD Model II Moisture Analyzer	calibration weights (10 mg -10 g)	weekly
Eppendorf Pipettes	Blue Eppendorf (100 - 1000 μL)	weights at 100, 250, 500, 750, 1000 μL	biweekly
	Yellow Eppendorf (10 - 100 μL)	weights at 10, 25, 50, 75, 100 μL	biweekly
Ion Selective Electrodes	Fluoride electrode	Slope	daily
	Chloride electrode	Slope	daily
	pH probes	Slope	daily
Oven Temperature Monitoring	Thermolyne Oven	45, 100, 230 °C verify with thermometer	quarterly
	Thermolyne Muffle Furnace	230, 700, 1000 °C verify with thermocouple	quarterly
FGD Chloride Process Analyzer	Ion Selective Electrode	Zero potential	daily
		Span slope	daily
	Deionized water	Conductivity	weekly

Method Validation

Analytical methods selected for use at the Bailly laboratory were validated prior to the start-up of the FGD facility. The method selection process was driven by criteria such as specifications associated with contractual agreements. Additional methods or adaptations of methods which were evaluated have been used at other FGD labs. A notable portion of the test methods summarized in Table 2-6 have been commonly used in the construction materials industry and were acquired from highly reputable sources such as ASTM. Validation procedures were also used to assess alternate analytical methodology which provided quicker turnaround and were less complex in nature.

Intralaboratory evaluation of these procedures was performed using certified reference materials. Appropriate reference standards were identified based upon sample matrices and concentration levels which were similar to that of the materials used and produced at the Bailly facility. Table 3-6 summarizes the statistical results obtained from method validation testing performed at the Bailly FGD lab.

Quality Control

Quality control is the process of validating data reported by a laboratory. Procedures which support data validation may include instrument calibration, analysis of reagent blanks, analyte recovery studies, and intralaboratory evaluation of reference standards.

There are two fundamental principles associated with quality control. The first principle is that no two things are entirely identical even though they may appear similar in nature. The second principle is that no measurement is ever absolute. This statement implies that analytical techniques will always have some inherent variation.

Table 3-6. Method Validation Testing Results for Bailly Laboratory

Parameter	Reference Standard	Unit of measure	Certified Value	Reported Std. Deviations	Number of Replicates	Mean	Avg. % Recovery	Standard Deviation	Precision (2 std. dev.)
Carbonate	Calcium carbonate	wt. %	60.0	NA	9	55.5	92.5	2.4	4.8
	NIST 1c (limestone)	wt. %	54.4	NA	5	51.8	95.2	1.3	2.6
	Domtar GYP-A (gypsum)	wt. %	0.64	0.08	2	0.56	88	NA	NA
	Domtar GYP-B (gypsum)	wt. %	6.8	0.27	2	6.22	91.5	NA	NA
	Domtar GYP-C (gypsum)	wt. %	15.3	0.07	2	14.2	92.8	NA	NA
	Domtar GYP-D (gypsum)	wt. %	4.9	0.41	1	4.9	100	NA	NA
Combined Water	Internal gypsum standard	wt. %	NA	NA	10	20.26	NA	0.04	0.08
Free Water	Internal gypsum standard	wt. %	NA	NA	10	12.13	NA	0.04	0.07
Slurry Density	APC-200 gypsum	wt. %	NA	NA	10	1.105	NA	0.002	0.003
Silica	NIST 1c (limestone)	wt., %	6.84		1	7.21	105	NA	NA
	Domtar GYP-A (gypsum)	wt. %	0.45	0.13	1	0.53	118	NA	NA
	Domtar GYP-B (gypsum)	wt. %	1.05	0.12	3	0.94	89.5	0.09	1.7
	Domtar GYP-C (gypsum)	wt. %	3.5	0.2	1	3.39	96.9	NA	NA
Sulfate	Domtar GYP-B (gypsum)	wt. %	49.20	0.72	6	48.67	NA	0.65	1.31
Weight % Solids	APC-200 gypsum	wt. %	15.0	NA	5	14.84	NA	0.09	0.18
Chloride	Domtar GYP-D (gypsum)	ppm	225	30	9	229	NA	9.3	19
Fluoride	Domtar FGD-2 (gypsum)	ppm	320	NA	1	317	99.1	NA	NA
Sulfite	Sodium sulfite	mmol/L	20	NA	5	18.2	NA	0.6	1.1
pH	Internal gypsum standard	pH units	NA	NA	10	8.35	NA	0.06	0.12

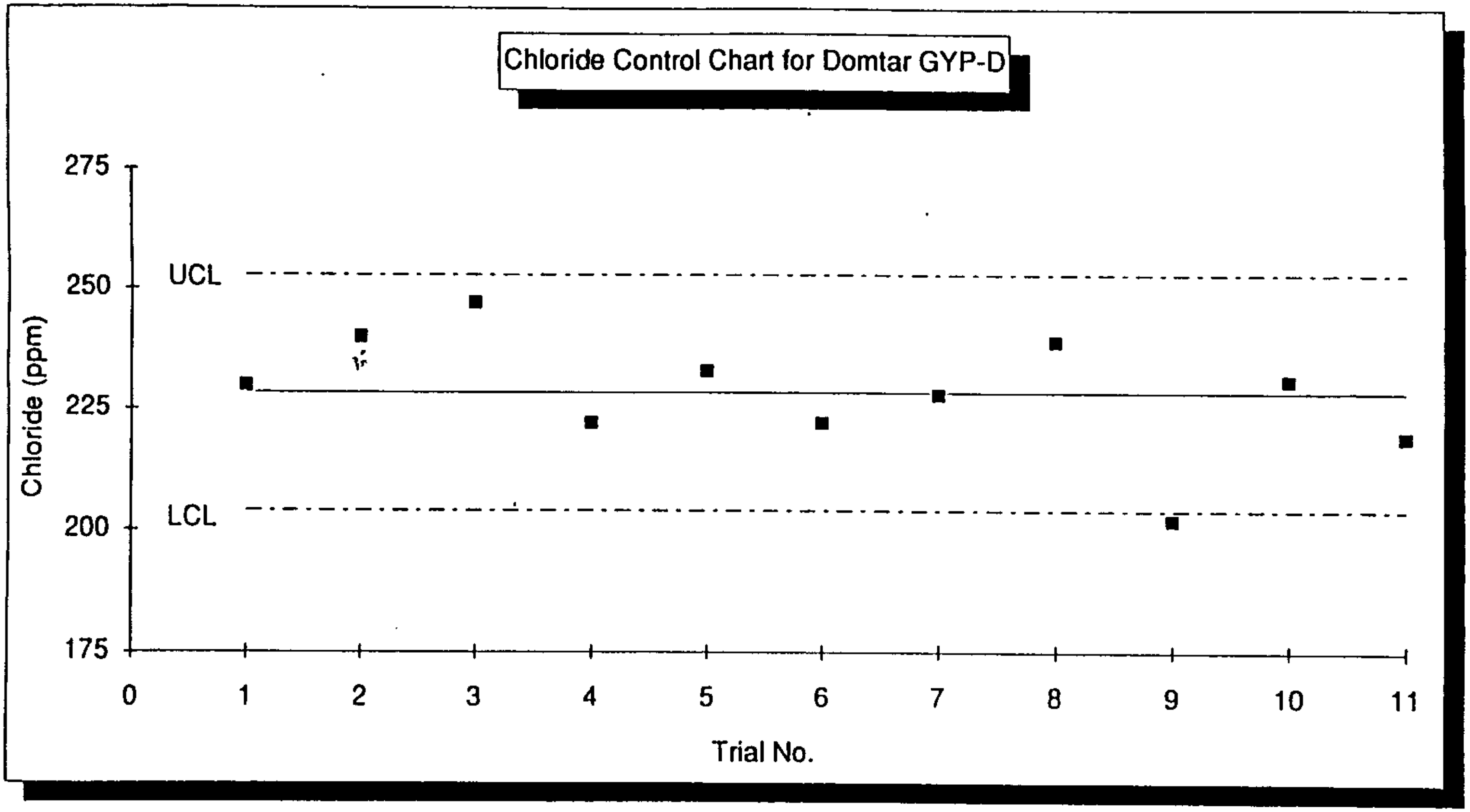
Quality control charts are used to provide a graphical assessment of accuracy and precision for the analysis of specific components in a sample. A mean control chart (accuracy) reveals the variation around the central tendency (x) of different groups of data. A range control chart (precision) measures the variation within a given group.

Quality control charting of instrument calibration data, internal QC samples, and certified reference materials is in progress within the Bailly lab. Control samples have yet to be analyzed frequently enough to generate statistically sound control charts. Control limits are set at 2 standard deviations from the mean. A mean control chart representing chloride data obtained from method validation obtained on Domtars' GYP-D standard is presented in Figure 3-3. Outlined below is the intended program to be followed to monitor quality control of chemical analyses performed in the Bailly FGD lab.

Quality Control Sample	Parameter	Frequency
Internal Gypsum Standard	Calcium Sulfate Combined Water Chloride Fluoride Carbonate Magnesium Silica	weekly
Certified Reference Material	Calcium Sulfate Combined Water Chloride Fluoride Carbonate Magnesium Silica	monthly

Additional forms of laboratory quality assurance such as personnel credentials, quality of equipment and supplies, safe work practices, and standard operating procedures are discussed separately in other parts of section 6.2.4.

Figure 3-3. Mean Control Chart Domtar GYP-D for Chloride



CONTRACT LAB SUPPORT

A literature search was conducted to obtain a list of prospective contract laboratories located in the midwest region which could provide quality analytical services to the Bailly FGD project. Specific areas of interest included experience in the following disciplines:

- Gypsum and limestone characterization
- Coal and fly ash determinations
- Water and wastewater analysis
- Solid and hazardous waste evaluation (TCLP / INLT)
- Radioactivity monitoring

These categories collectively represent those items which were required to be addressed during the execution of the EMP and DOE demonstration test plans. The monitoring of these process streams was also essential to evaluate performance of the FGD system.

The lab evaluation program (LEP) consisted of four phases, each with its own set of criteria, aimed at procuring and maintaining quality contract lab analytical resources for the Bailly FGD project. The scope of the evaluation program is provided in the following outline.

Phase I

- analytical instrumentation resources and testing capabilities
- scope of analytical services / technical expertise
- quality assurance / quality control program
- accessibility

Phase II

- evaluate performance using certified reference materials
- timeliness (sample turnaround)

Phase III

- cost evaluation of required analytical services

Phase IV (on-going)

- periodic performance monitoring
- accommodating priority requests
- sample turnaround
- technical support

Contacts with representatives from these analytical labs were established to obtain documentation on analytical services and professional qualifications. Site visits (Phase I) were scheduled with the potential candidates after reviewing appropriate credentials. The general purpose of the site visit was to provide a forum for information exchange between the interested parties. Activities which took place during the site visits included:

- presenting an overview of the Pure Air flue gas desulfurization process
- outlining Pure Air's analytical testing requirements
- discussing the contract lab evaluation program and selection process
- performing a walk through evaluation of laboratory facilities
- assessing the suitability of the contract laboratory
- obtaining references and analytical pricing information.

A select number of candidates were identified in the environmental and process support disciplines from this initial screening process. An evaluation of these labs (Phase II) was performed using certified reference materials (CRM) as blind samples. Results were compared against the known values of the CRM's and also with the data submitted by other labs participating in the evaluation program.

A summary of the results provided by the contract labs on gypsum and limestone CRM analysis can be found in Table 3-7. A rating system was devised to quantify the analytical performance of each lab. The assessment ratings found at the bottom of this table reflects the accuracy of the lab result as compared against the certified value for a given parameter. The lab reporting closest to the certified value (% recovery) received the highest rating. Identical ratings were assigned to lab results reported within the two sigma level.

Table 3-7. Contract Lab Performance Evaluation on Gypsum and Limestone

Parameter	Certified Value	Std. Deviations	Laboratory A Reported Value	Laboratory A % Recovery	Laboratory B Reported Value	Laboratory B % Recovery	Laboratory C Reported Value	Laboratory C % Recovery
GYPSUM								
CaO (%)	32.8	0.4	32.65	100%	31.6	96%	35.0	107%
SO3 (%)	41.0	0.6	41.77	102%	39.92	97%	51.9	127%
Combined Water (%)	17.80	0.08	18.12	102%	17.92	101%	17.4	98%
Chloride (ppm)	34	5	70	206%	100	294%	17000	50000%
Fe2O3 (%)	0.07	0.01	0.08	114%	0.15	214%	0.065	93%
Al2O3 (%)	0.17	0.04	0.17	100%	0.19	112%	0.253	149%
SiO2 (%)	1.05	12	0.86	82%	0.85	81%	0.225	21%
K2O (%)	0.05	0.01	0.02	40%	0.11	220%	0.116	232%
MgO (%)	1.80	0.1	1.64	91%	1.68	93%	1.82	101%
Na2O (%)	0.021	0.005	0.01	48%	0.05	238%	0.04	167%
CO2 (%)	5.0	0.2	4.87	97%	5.8	116%	2.3	46%
P2O5 (%) *	0.010	0.003	0.12	1200%	0.05	500%	NA	NA
SrO (%) *	0.14	0.02	0.01	7%	NA	NA	NA	NA
LOI (%) *	22.85	0.03	22.98	101%	23.4	102%	NA	NA
LIMESTONE								
CaO (%)	55.4		56.0	101%	54.0	97%	58.8	106%
SiO2 (%)	0.70		0.80	114%	0.86	123%	0.15	21%
MgO (%)	0.15		0.08	53%	0.16	107%	0.2	133%
Fe2O3 (%)	0.045		0.03	67%	0.14	311%	0.049	109%
Al2O3 (%)	0.12		0.12	100%	0.18	150%	0.118	98%
S (%)	0.007		NA	NA	0.03	429%	0.019	271%
SrO (%)	0.019		NA	NA	NA	NA	0.02	105%
TiO2 (%)	0.009		0.02	222%	0.02	222%	0.006	67%
CO2 (LOI) (%)	43.4		43.55	100%	43.3	100%	42.5	98%
K2O (%) *	0.02		<0.01	< 50%	0.07	350%	NA	NA
Na2O (%) *	0.02		0.04	200%	0.03	150%	NA	NA
P2O5 (%) *	0.006		<0.01	< 167%	0.06	1000%	NA	NA
MnO (%) *	0.010		0.009	90%	0.03	300%	NA	NA
Assessment Rating			82%		65%		57%	

* Denotes additional results provided by contract lab participants

Table 3-8 summarizes the data obtained from those labs reporting results pertaining to environmental matrices. The assessment rating used in Table 3-8 was defined as the percentage of a lab's reported data falling within the 95% confidence level.

The Phase III objective was to identify two labs within each of the specialized testing functions which would be capable of supporting the analytical testing protocol as defined by their performance in Phase II. After receiving quotations for specified analytical services from the final candidates, primary and secondary vendors were selected based upon the criteria outlined in the lab evaluation program.

Phase IV activities were developed to ensure the selected contract labs would consistently provide analytical services which would meet the expectations of project personnel. Measurement tools used to assess the quality of services provided include: periodic analytical performance evaluations, tracking sample turnaround time, flexibility for handling priority (rush) analyses, and monitoring analytical service charges.

Appendix A contains a list of contract laboratories which were used to support the physical and chemical testing requirements associated with the operation of the Pure Air Bailly Generating Station.

Table 3-8. Environmental Contract Lab Performance Evaluation

Parameter	Certified Value	Confidence Interval (95%)	Laboratory D Reported Value	Laboratory D % Recovery	Laboratory E Reported Value	Laboratory E % Recovery	Laboratory F Reported Value	Laboratory F % Recovery	Laboratory G Reported Value	Laboratory G % Recovery	Laboratory H Reported Value	Laboratory H % Recovery
WASTEWATER (ppm)												
Dissolved Solids	1260	1064-1521	1160	92.1%	1170	92.9%	1200	95.2%	1300	103%		
Chloride	208	193-222	196	94.2%	190	91.3%	190	91.3%	200	96.2%		
Fluoride	8.58	7.88-9.00	9.08	106%	8.3	97%	7.2	84%	8.7	101%		
Sulfate	236	205-260	228	96.6%	157	66.5%	245	104%	230	97.5%		
Oil & Grease	63.7	NA	60	94%	67	105%	22	35%	44	69%		
BOD	30.5	20-38	16.8	55.1%	29	95%	26	85%	23	75%	20	66%
COD	50.9	43-58	44.4	87.2%	43	84%	49	96%	27	53%	52	102%
TOC	19.8	17-23	21	106%	15.1	76.3%	21	106%	20	101%	20	101%
Cyanide (total)	0.121	0.088-0.154	0.118	97.5%	0.087	72%	0.068	56%	0.081	67%	0.096	79%
Phenols (total)	0.067	0.051-0.083	0.073	109%	0.077	115%	0.05	75%	0.063	94%		
DRINKING WATER (ppb)												
Antimony	149	112-176	193	130%	180	121%	180	121%	160	107%	140	94.0%
Arsenic	156	117-184	200	128%	160	103%	210	135%	160	103%	160	103%
Cadmium	125	103-148	142	114%	154	123%	150	120%	130	104%	120	96%
Selenium	37.4	28-44	46	123%	41	110%	35	94%	41	110%	< 0.02	< 0.1%
Silver	42.8	35-51	53	124%	8.6	20%	57	133%	36	84%	40	93%
Chromium	207	170-244	237	114%	258	125%	270	130%	220	106%	230	111%
Copper	173	142-204	195	113%	208	120%	200	116%	190	110%	190	110%
Nickel	178	146-210	204	115%	227	128%	230	129%	190	107%		
Thallium	54.1	41-64	56	104%	57	105%	61	113%	< 390	< 721%		
Iron	426	349-503	460	108%	502	118%	490	115%	430	101%	440	103%
Lead	130	107-153	145	112%	164	126%	150	115%	NA	NA		
Mercury	7.35	5.5-9.2	6.39	86.9%	7.7	105%	4.9	67%	7	95%	3	41%
Hardness	84.4	69-100	92.8	110%	106	126%	96	114%	94	111.4%	92.5	110%

Table 3-8. Environmental Contract Lab Performance Evaluation

Parameter	Certified Value	Confidence Interval (95%)	Laboratory D Reported Value	Laboratory D % Recovery	Laboratory E Reported Value	Laboratory E % Recovery	Laboratory F Reported Value	Laboratory F % Recovery	Laboratory G Reported Value	Laboratory G % Recovery	Laboratory H Reported Value	Laboratory H % Recovery
REGULATED VOLATILES (ppb)												
Benzene	1.61	0.60-2.4	1.46	90.7%	2	124%	1.6	99%	< 5	< 311%	1.4	87%
Carbon Tetrachloride	3.06	2.1-4.3	2.36	77.1%	3	98%	2.4	78%	< 5	< 164%	2.7	88%
1,4-Dichlorobenzene	5.10	1.8-9.7	5.14	101%	6	118%	3.3	65%	5	98%	4.8	94%
1,2-Dichloroethane	10.2	5.0-16	11	108%	12	118%	11	108%	12	118%	8.2	80%
1,1-Dichloroethene	18.2	3.4-26	20	110%	21	115%	18	99%	22	121%	19	104%
1,1,1-Trichloroethane	3.79	2.0-6.1	4.33	114%	3	79%	2.8	74%	5	132%	3.4	90%
Trichloroethene	13.6	9.6-21	13	95.6%	12	88%	12.4	91%	12	88%	12	88%
Vinyl chloride	1.20	0.18-3.0	< 5	< 417%	< 0.5	< 42%	0.33	28%	< 10	< 833%	0.7	58%
DRIED SLUDGE (ppm)												
Arsenic (ppm)	200	150-240	170	85.0%	217	109%	180	90.0%	170	85.0%		
Cadmium	7.6	6.0-9.2	7.31	96.2%	9.24	122%	7.9	104%	5.6	74%		
Chromium	38	30-50	38.8	102%	38.3	101%	43	113%	30	79%		
Mercury	100	65-140	69.2	69.2%	133	133%	72	72%	100	100%		
Molybdenum	12	9.0-15	10.9	90.8%	10	83%	29	242%	25	208%		
Selenium	202	140-240	168	83.2%	234	116%	140	69.3%	190	94.1%		
Lead	510	400-610	414	81.2%	431	84.5%	510	100%	430	84.3%		
Nickel	21	16-26	22.8	109%	20.6	98.1%	22	105%	16	76%		
Zinc	1800	1400-2200	1440	80.0%	1530	85.0%	1800	100%	2400	133%		
Aluminum	10200	8200-12300	8450	82.8%	8220	80.6%	10000	98.0%	14000	137%		
Iron	16700	13300-20000	15100	90.4%	14800	89%	17000	101.8%	14000	83.8%		
Assessment Rating			85%		71%		71%		82%		91%	

LAB SAFETY

The mission of a safety program is to provide for a safe, healthy, accident-free work environment. A secondary objective is to prevent damage to company assets. At Pure Air, "there is nothing more important than safety." This safety philosophy applies to the FGD laboratory which is part of the overall plant safety program.

Bailly staff members were required to participate in the Federal Right-To-Know Program which communicates the potential hazards of substances used in the workplace and how the individual can protect themselves. The program addressed five key topics which included:

- informing employees of operations where chemical hazards are present
- requirements of the Hazard Communication Law and the availability of the facility's written Federal Right-To-Know Program
- chemical labeling
- chemical inventorying and hazard assessment
- reviewing Material Safety Data Sheets to obtain hazard information

The use of personal protective equipment (PPE) is a condition of employment and must be worn or used as determined by the safe work practice or hazard assessment. At a minimum, steel toe safety shoes, safety glasses with side shields, and hard hats are required when on-site at the Bailly facility. The use of additional PPE such as hearing protection, gloves, and protective clothing may be required when entering into specific areas of the FGD unit.

In addition to the above, the following general guidelines have been established for the Bailly laboratory:

- hygiene - food and beverages are not permitted to be stored or consumed in the lab. Smoking is prohibited on all Pure Air property. Appropriate laboratory dress is dictated by the work performed.
- housekeeping - labs should be kept neat and clutter free. Cleanups should be performed at the completion of an operation or at the end of the day.

- waste disposal - spilled chemicals must be cleaned up immediately and disposed of properly.
- open flames - open flames are permitted except where specifically posted or where flammable vapors are in close proximity.
- labeling - chemicals received from outside sources must be affixed with a label containing the following information: chemical name, date of receipt and expiration, and a coded NFPA diamond hazard assessment.
- protective devices - protective shields, relief valves, safety signs (acid, hot), rubber carriers for transporting glass bottles, and spill containment supplies are to used as necessary.
- gas equipment - cylinders are to be secured and capped when not in use. Gas lines should be labeled when passing out of sight from the source to the point of use.

A comprehensive listing of safe work practices[14] (SWP) or operational procedures (SOP) of laboratory functions is available at the Bailly FGD lab. The SWP's were developed by Air Products' research staff in order to train personnel proper and safe methods for performing specific laboratory work. The safe work practice is a detailed procedure for a particular operation that outlines:

- steps involved in completing an operation
- potential hazards
- personal protective equipment required
- procedures for emergency shutdown

Appendix C contains a list of safe work practices which are applicable to operations performed in the Bailly FGD laboratory.

Table 3-9 contains a listing of safety and general housekeeping supplies which are available for lab personnel. Additional items such as first aid cabinets, Scott Air Packs, atmospheric monitors, and other PPE are in close proximity and available for use as needed. Weekly safety meetings address personnel training in areas such as : CPR and first aid, firefighting, safety permit systems, forklift operation, and electrical safety. Safety meeting agendas also cover topics which are specific to functional tasks performed at the facility.

Table 3-9. Lab Safety and Maintenance Items

Acid Bottle Carrier, Rubber	Lab Coats
Chemical ID Labels	Leather Gloves
Face Shield, Safety	Mercury Sponge w/ Activator
Fire Extinguisher, ABC Type	MSDS Binder
Gloves, Vinyl Disposable Large	Neutrasorb, Acid Spill, 3.2 kg.
Goggles, Safety	Safety Glasses
Hand Protector, Hot Hand	Safety Signs - Miscellaneous
Hazard Rating Guide	Solusorb, 1.1 kg.
Lab Aprons	Spill-X-A

Beaker Brush	Pipet Drawer Organizer
Clamp Drawer Organizer	Stopper Drawer Organizer
Cylinder Brush	Tray, Polyprop 15x20x3
Drawer Liners, Nalgene 18"x50'	Pipet Rack
Glass Cleaner	Sample Bags
Kimwipes EX-L, 12x12	Liqui-Nox Detergent
Paper Towels	Utility Carrier, Nalgene

SECTION 6.2.4

REFERENCES

1. 1990 Annual Book of ASTM Standards; Section 5: Petroleum Products, Lubricants, and Fossil Fuels, Vol. 5.05: Gaseous Fuels; Coal and Coke, ASTM, Philadelphia, PA, 1990.

2. 1990 Annual Book of ASTM Standards; Section 4: Construction, Vol. 4.01: Cement; Lime; Gypsum, ASTM, Philadelphia, PA, 1990.

3. Test Methods for Evaluating Solid Waste; November 1986, SW-846, 3rd ed.; U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. U.S. Government Printing Office: Washington, DC, 1986. Vols. 1, 2.

4. Methods for Chemical Analysis of Water and Wastes; Environmental Monitoring and Support Laboratory. U.S. Environmental Protection Agency, Office of Research and Development. Cincinnati, OH, March 1983; EPA-600/4-79-020.

5. Code of Federal Regulations, Title 40 - Protection of Environment, Part 261.21, Characteristic of Ignitability. U.S. Environmental Protection Agency. U. S. Government Printing Office: Washington, DC, July 1992.

6. Varian Analytical Methods for Graphite Tube Atomizers; Rothery, E. Ed.; Varian Techtron Pty. Limited, Mulgrave, Victoria, Australia, 1982.

7. FGD Chemistry and Analytical Methods Handbook; Chemical and Physical Test Methods, Electric Power Research Institute, EPRI CS-3612, Vol. 2, Project 1031-4; Palo Alto, CA, July 1984.

8. Standard Methods for the Examination of Water and Wastewater; 17th ed.; Clesceri, L. S. et al., Eds.; American Public Health Association: Washington, DC, 1989.

9. Standard Methods for the Examination of Water and Wastewater; 16th ed.; Greenberg, A. E. et al., Eds.; American Public Health Association: Washington, DC, 1985.

10. Sampling and Analysis Procedure, Elkraft AVV Project, Drawing no. 7799 B406-00100, Rev. P; Mitsubishi Heavy Industries, LTD: Tokyo, Japan; August 1989.

11. Kriebel B. W., Pure Air Laboratory Notebook No. 1000, Pure Air on the Lake: Chesterton, IN, March 1992.

12. Chemical Gypsum Test Methods, USG Corporation Research Center: Libertyville, IL, 1989.

13. Kanare H. M., Chemical and Physical Analyses for Bailly FGD Project, Construction Technology Laboratories Inc; Project No. 404058, Skokie, IL.

14. Safe Work Practices for R&D Laboratories, Vols.1, 2; R&D Safety Policy Committee, Air Products and Chemicals, Inc: Allentown, PA; September 1992.

APPENDIX A

CONTRACT LABORATORIES

The following list of contract laboratories supported test programs at the Bailly FGD facility by providing analytical services in the following specialized areas:

Construction Technology Laboratories, Inc. (primary)
5420 Old Orchard Road
Skokie, IL

Gypsum	Process Intermediates	Limestone	Fly ash
General metals	Elemental analysis	General metals	General metals
Particle sizing	Particle sizing	Particle sizing	Phase identification
Microscopy	Microscopy		
Phase identification			

Standard Laboratories, Inc.
1530 N. Cullen Avenue
Evansville, IN 47715

Coal	Fly ash
Proximate analysis	General metals
Ultimate analysis	
General metals	

Sherry Laboratories (primary)
2203 South Madison Street
Muncie, IN 47302

Process Water	Wastewater Influent	Wastewater Effluent	Gypsum	Fly Ash
General metals	General metals	General metals	TCLP	TCLP
			INLT	INLT

Teledyne Isotopes - Midwest Laboratory
700 Landwehr Road
Northbrook, IL 60062-2310

Gypsum	Limestone	Coal	Fly Ash
Radioactivity	Radioactivity	Radioactivity	Radioactivity

APPENDIX B

LABORATORY PRODUCTS DISTRIBUTORS

Air Products Specialty Gases Catalog 1
Air Products Specialty Gases Equipment Catalog 2
Air Products and Chemicals, Inc.
Specialty Gas Department
Chicago, IL 60628

Catalog Handbook of Fine Chemicals
Aldrich Chemical
1001 West Saint Paul Avenue
Milwaukee, WI 53233

Brammer Standards Catalog -1992
Brammer Standard Co.
14603 Benfer Road
Houston, TX 77069

Fischer Catalog - 1992
Fischer Scientific
1600 W. Glenlake Avenue
Itasca, IL 60143

Kewuanee Scientific Corporation
C. E. Shomo & Associates
P.O. Box 405
Evanston, IL 60204

Lab Glass General Catalog - 1992
Lab Glass, Inc.
1172 North West Blvd.
Vineland, NJ 08360

General Catalog - 1991
Lab Safety Supply, Inc.
P.O. Box 1368
Janesville, WI 53547-1368

Millipore Direct Catalogue
Millipore Products Division
Bedford, MA 01730

NIST Standard Reference Materials Catalog 1991-1992
U.S. Department of Commerce
Technology Administration
National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202, Room 204
Gaithersburg, MD 20899

Orion Research Inc.
The Schrafft Center
529 Main Street
Boston, MA 02129

Biochemicals, Organic Compounds for Research and Diagnostic Reagents
Sigma Chemical Company
P.O. Box 14508
St. Louis MO 63178

VWR Scientific Apparatus Catalog 1991-92
VWR Scientific
P.O. Box 66929
Chicago, IL 60666

APPENDIX C

SAFE WORK PRACTICES[14]

SWP Reference	TITLE
A-3	Dispensing of Chemicals/Solvents into Glassware
A-8	Handling Hot Acids
A-11	Dispensing of Concentrated Acids
B-1	Connecting Rubber Tubing with Glass Rod or Tubing
B-2	Inserting Thermometer into Cork or Rubber Stopper
B-3	Removal of Tubing from Glassware
B-4	Handling and Cleaning of Glassware
B-6	Use of Hotplates
B-9	Working with Open Flames (Bunsen Burner)
B-10	Use of Lab Furnaces
B-21	Gas Cylinder Transport/Changing
B-24	Use of a pH meter
B-25	Preparation of Standard Acid and Caustic Solutions
B-29	Use of Utility Knife for Opening Bags and Boxes
C-8	Charging/Removing Samples from Muflle Furnace
G-8	Handling Hydrofluoric Acid
H-1	Spill Handling Procedures - General
H-2	Clean Up of Broken Glassware
H-3	Safe Handling of Mercury (Spill Cleanup)
H-4	Clean Up of Flammable Liquid Spill

6.3 Trace Components

There are several trace components in the FGD system that are of importance. These compounds come from several sources. They are:

SOURCES OF TRACE COMPONENTS

TABLE 6-1

FLUEGAS	FLYASH	LIMESTONE	WATER MAKEUP
HF	FLUORINE	FLUORINE	
HCl	CHLORINE	CHLORINE	CHLORINE
	ALUMINUM	ALUMINUM	
	MANGANESE	MANGANESE	MANGANESE
	MAGNESIUM	MAGNESIUM	MAGNESIUM
	POTASSIUM	POTASSIUM	POTASSIUM
	SODIUM	SODIUM	SODIUM
	IRON	IRON	IRON
	SILICON	SILICON	SILICON

Hydrogen fluoride and hydrogen chloride enter the absorber as gas components in the flue gas. These compounds come from the combustion of coal. Some gas phase compounds are removed by the absorber module and appear in the circulating slurry liquor. HCL entering the absorber generates water soluble chloride salts which cannot be removed without purging. As an illustration, the typical full-load daily coal consumption of the power station is 5000 tons per day. The choride concentration of the coal during the first test was 0.07% which represents a chloride loading of 7000 pounds per day. The level of choride in the slurry is monitored and the purge rate is adjusted accordingly to maintain the concentration.

Approximately 300 pounds per hour of fly ash enters the FGD unit due to fly ash slippage through the Electrostatic Precipitators (ESPs). The fly ash is a source of aluminum compounds whose solubility is a function of pH. Limestone is a source of fluorine compounds which can accumulate in the absorber. The formation of aluminum fluoride compounds in limestone slurry systems is well known and is monitored closely for its effect on limestone reactivity. The other compounds are of interest, since the water soluble component concentrations are controlled as a result of the chloride ion concentration control. The following graphs give the results of a series of tests over the period of the testing program. Samples were taken from the absorber module, filtrate from the centrifuges, thickener underflow and overflow. An anomaly appeared in the sample taken on September 16. This can be seen in the graphs of the trace component concentration. This sudden rise is attributed to a fly ash excursion in to the absorber module. This can be seen in Graph 6-9, which is a graph of the flue gas opacity entering the FGD unit and is directly related to the fly ash loading.

SECTION 6.3

	MANGANESE	8/25/92	9/2/92	9/10/92	9/16/92	9/24/92
ABSORBER	PPM	39.9	39.9	200	50	60
FILTRATE	PPM	20	20	20	20	20
THICK UNDERFLOW	PPM	40	40	40	40	40
THICK OVERFLOW	PPM	48	51	36	32	41

	ALUMINUM	8/25/92	9/2/92	9/10/92	9/16/92	9/24/92
ABSORBER	PPM	15	30	740	330	210
FILTRATE	PPM	28	52	78	120	130
THICK UNDERFLOW	PPM	91	510	1000	851	740
THICK OVERFLOW	PPM	1.8	2.4	2.1	2.9	2.9

	FLUORIDE	8/25/92	9/2/92	9/10/92	9/16/92	9/24/92
ABSORBER	PPM	7.3	8.9	10	10.8	9.2
FILTRATE	PPM	6.8	8.3	8.5	9.1	7.9
THICK UNDERFLOW	PPM	6.4	7.6	6.8	7.2	6.6
THICK OVERFLOW	PPM	7.9	9.1	2.1	10.9	8.9

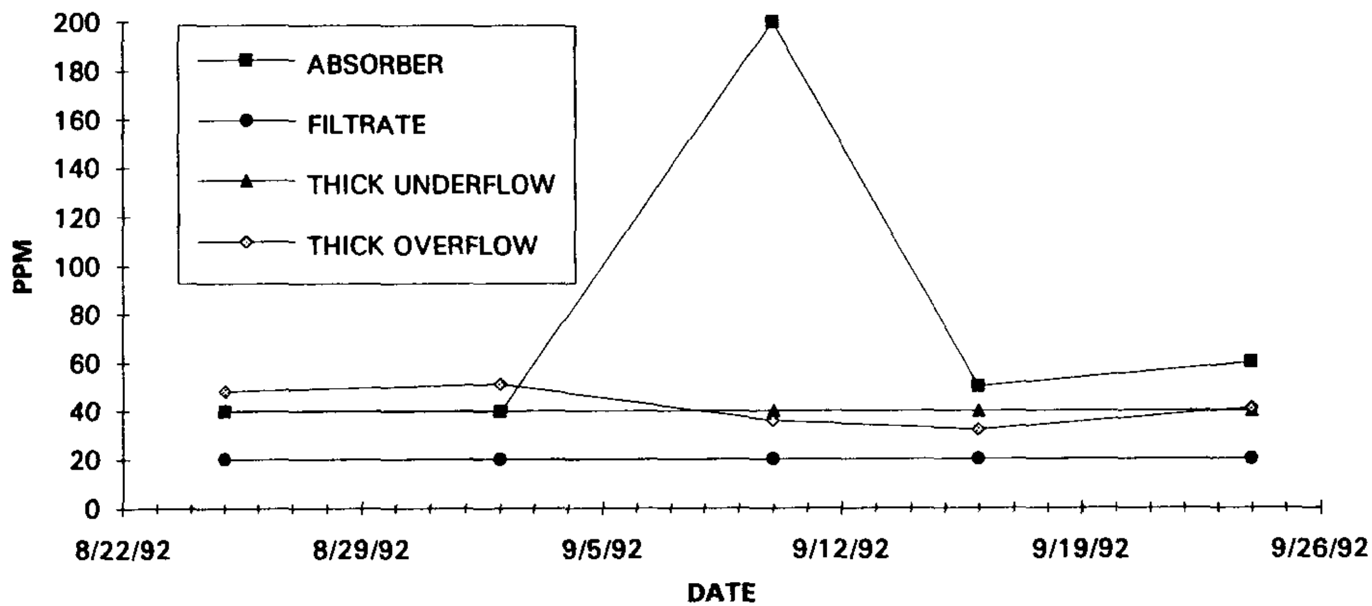
	SODIUM	8/25/92	9/2/92	9/10/92	9/16/92	9/24/92
ABSORBER	PPM	20	290	1050	350	240
FILTRATE	PPM	78	92	110	120	75
THICK UNDERFLOW	PPM	200	250	290	250	250
THICK OVERFLOW	PPM	210	200	110	140	120

	SILICATE	8/25/92	9/2/92	9/10/92	9/16/92	9/24/92
ABSORBER	PPM	680	680	3810	1900	1370
FILTRATE	PPM	230	340	420	565	642
THICK UNDERFLOW	PPM	750	3020	4642	3872	3572
THICK OVERFLOW	PPM	26	26	30	32	43

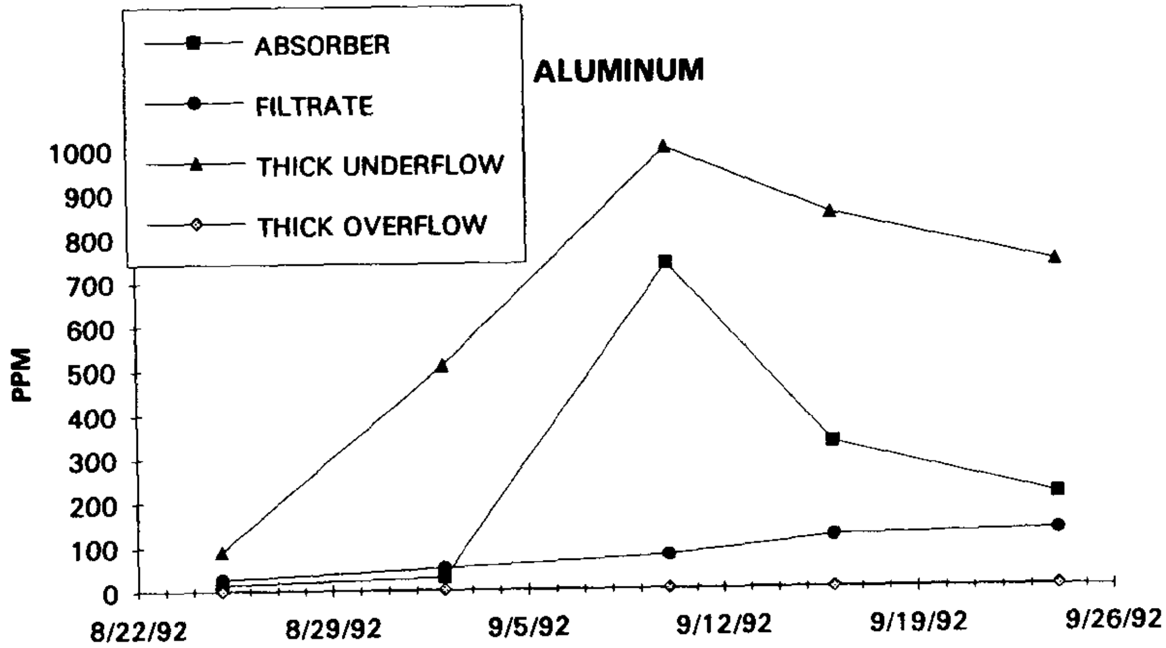
	IRON	8/25/92	9/2/92	9/10/92	9/16/92	9/24/92
ABSORBER	PPM	320	330	1490	640	480
FILTRATE	PPM	85	140	160	210	230
THICK UNDERFLOW	PPM	280	1160	1720	1390	1300
THICK OVERFLOW	PPM	1.6	1.6	5.9	3.7	2.3

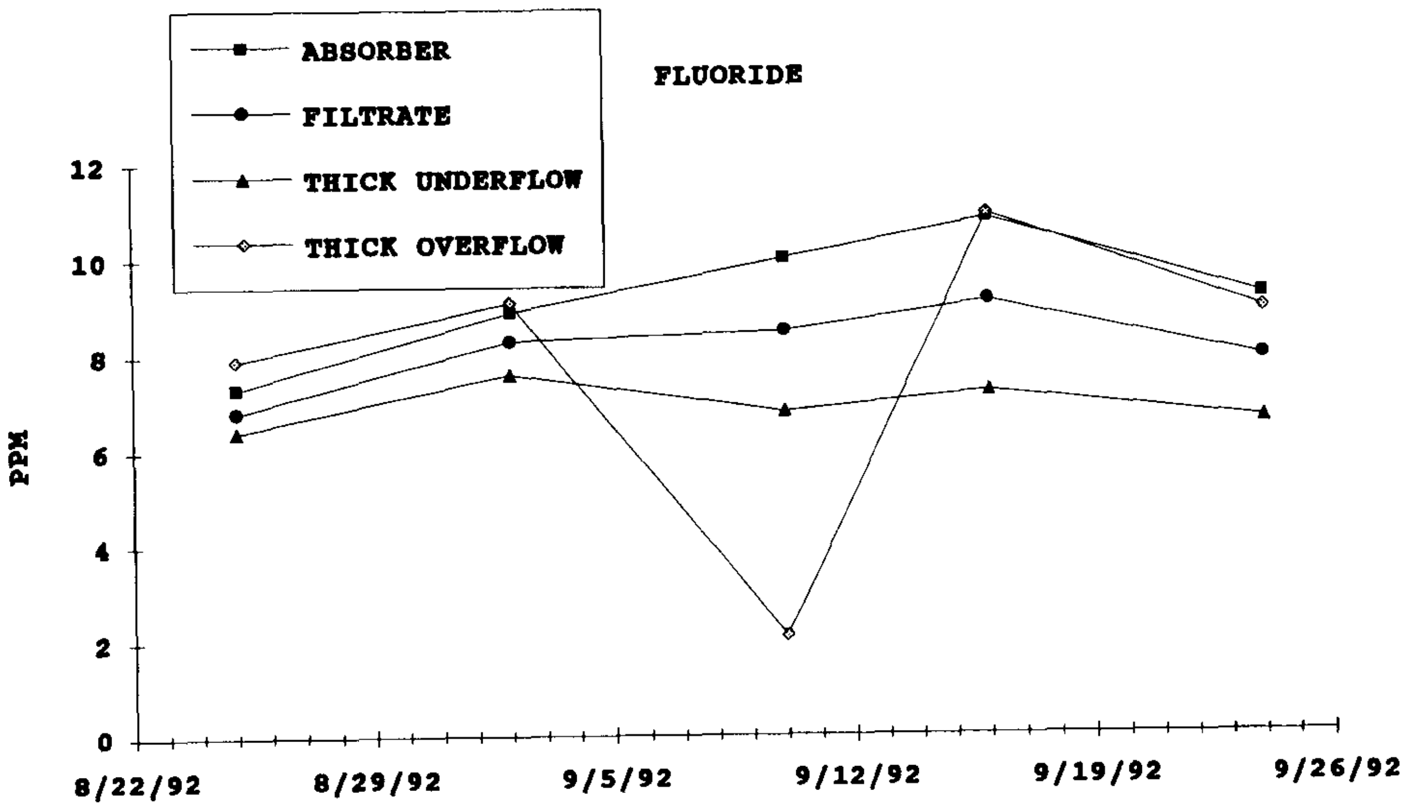
	POTASSIUM	8/25/92	9/2/92	9/10/92	9/16/92	9/24/92
ABSORBER	PPM	20	20	270	120	20
FILTRATE	PPM	41	30	29	54	7
THICK UNDERFLOW	PPM	91	200	190	230	50
THICK OVERFLOW	PPM	22	23	25	16	18

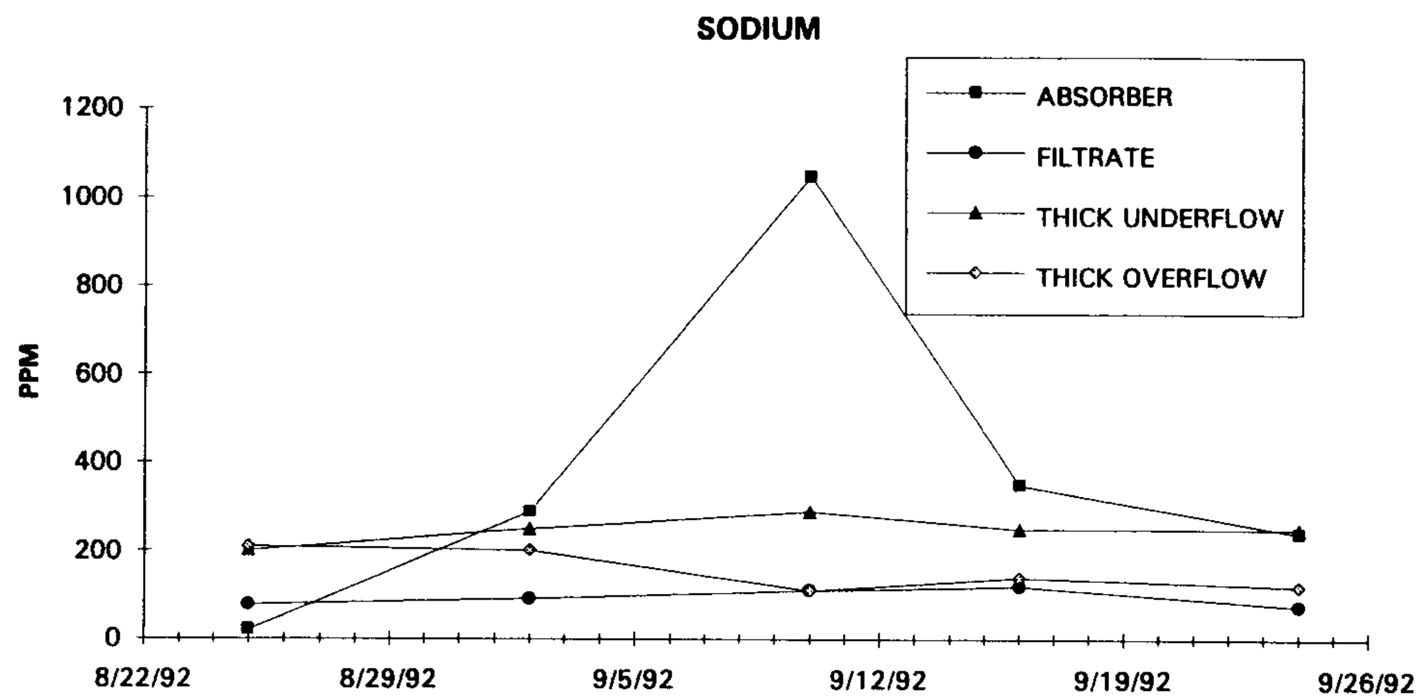
MANGANESE

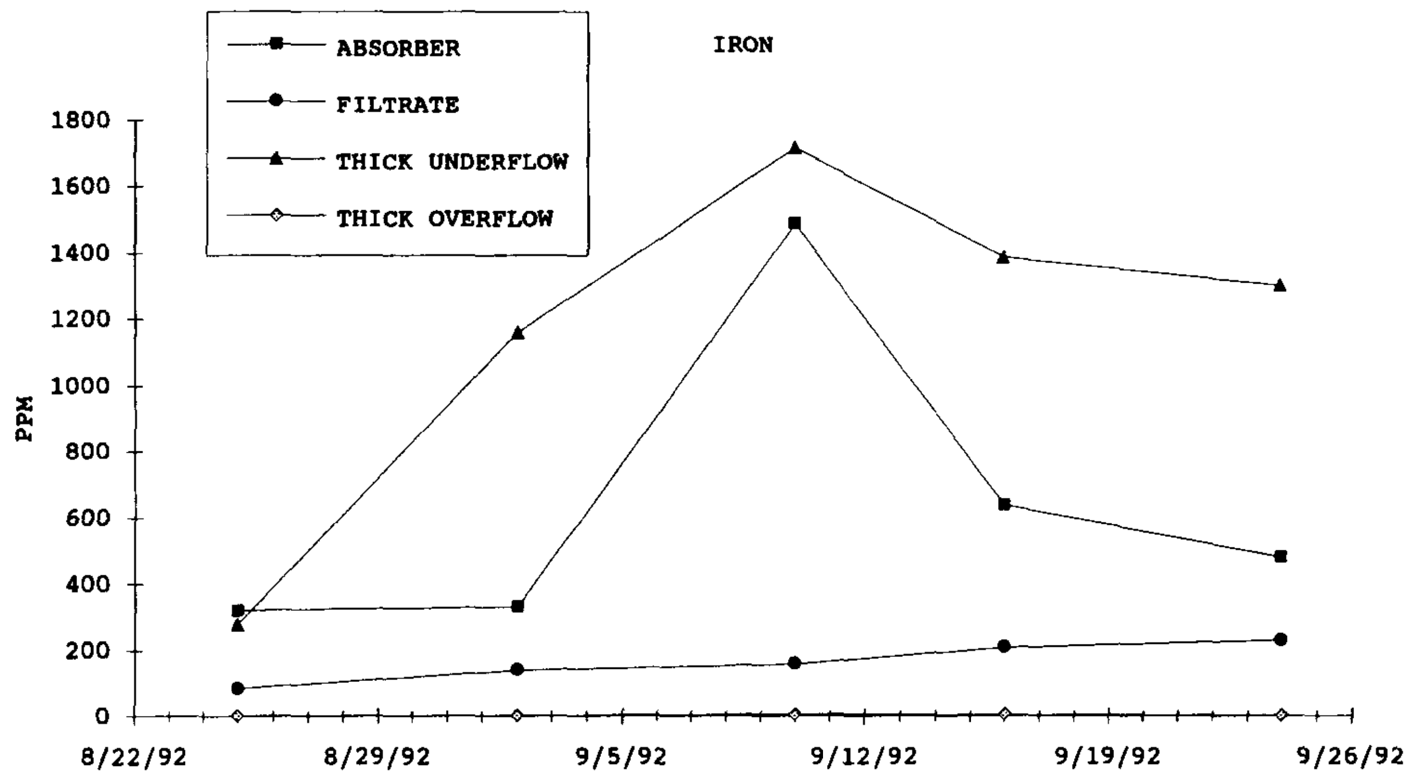


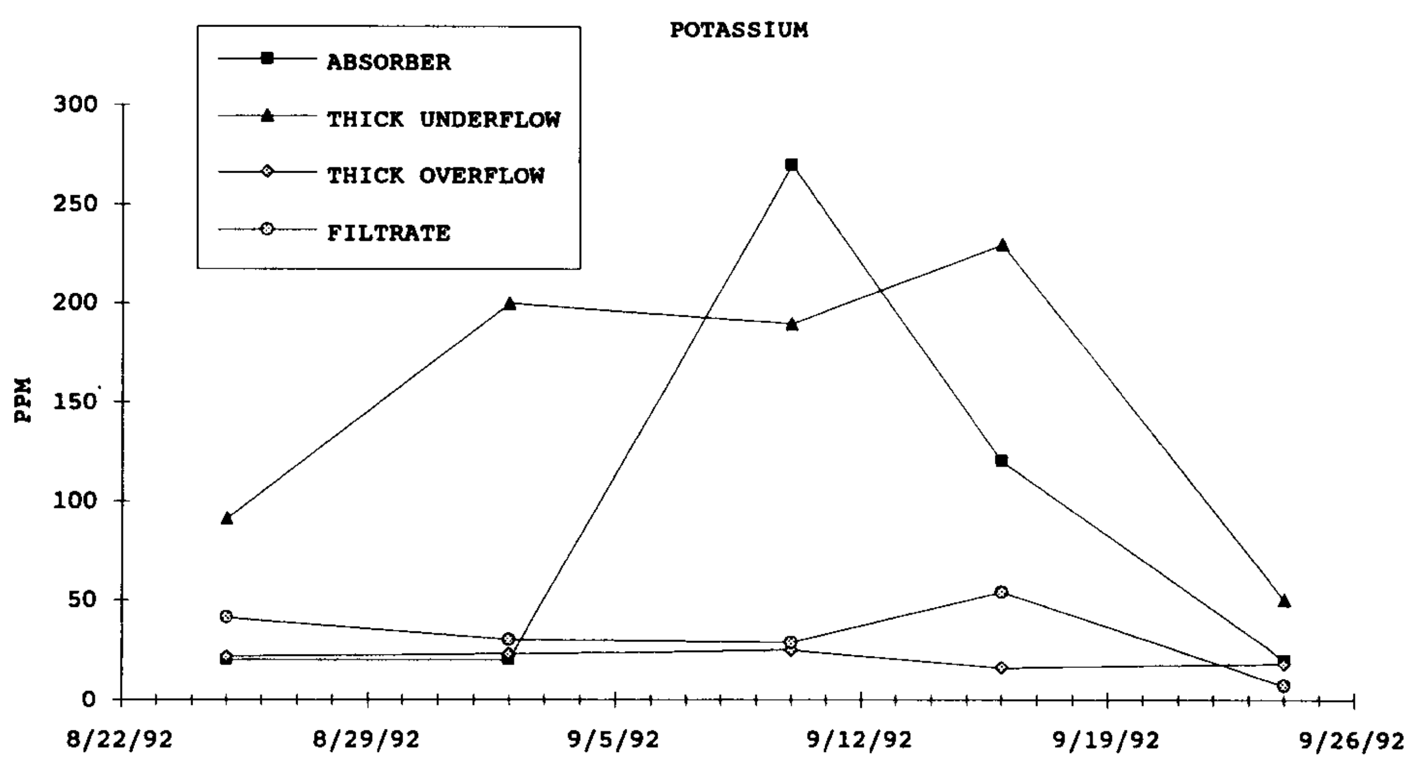
200
180
160
140
120
100
80
60
40
20
0
PPM
ABSORBER
FILTRATE
THICK UNDERFLOW
THICK OVERFLOW
8/22/92
8/29/92
9/5/92
9/12/92
9/19/92
9/26/92
DATE


ALUMINUM
ABSORBER
FILTRATE
THICK UNDERFLOW
THICK OVERFLOW
PPM
1000
900
800
700
600
500
400
300
200
100
0
8/22/92
8/29/92
9/5/92
9/12/92
9/19/92
9/26/92

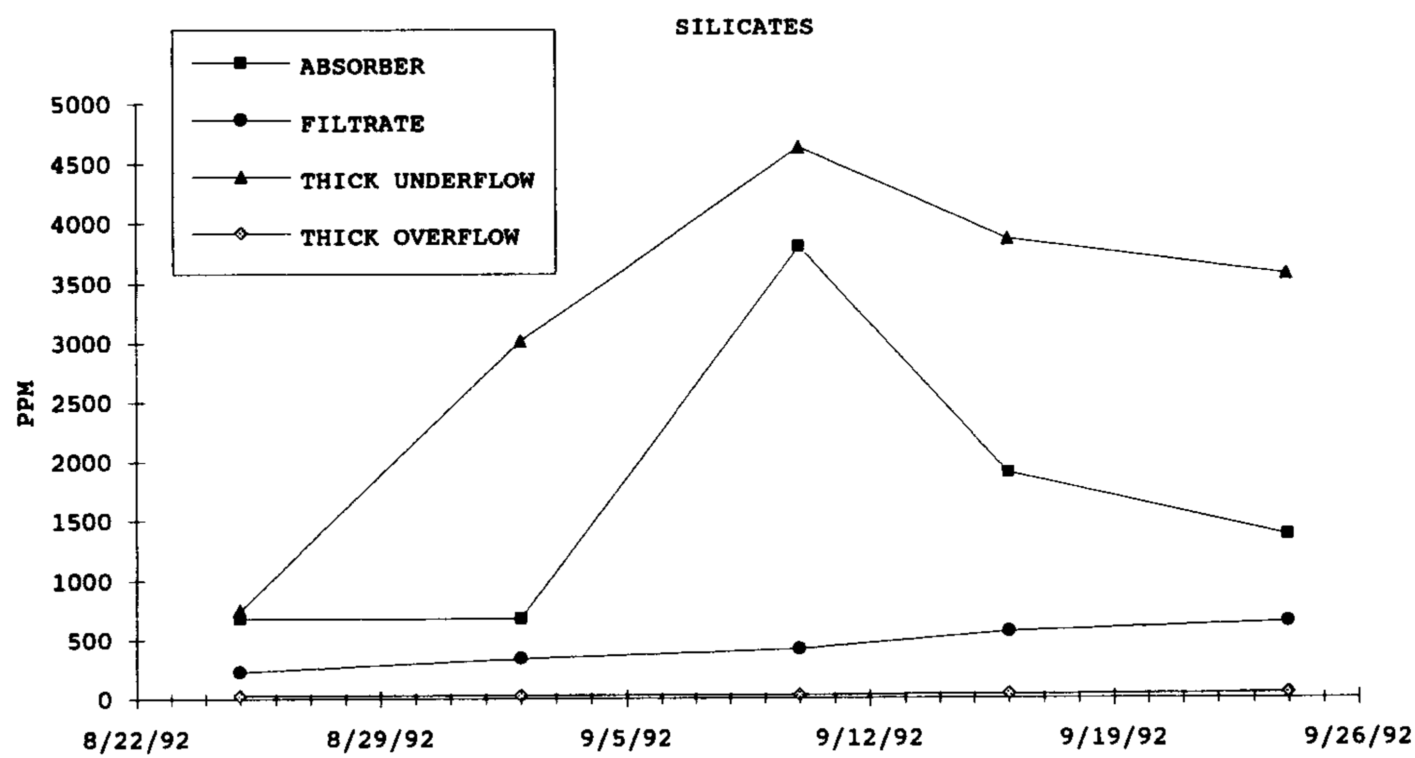

FLUORIDE
ABSORBER
FILTRATE
THICK UNDERFLOW
THICK OVERFLOW
PPM
0
2
4
6
8
10
12
8/22/92
8/29/92
9/5/92
9/12/92
9/19/92
9/26/92


SODIUM
ABSORBER
FILTRATE
THICK UNDERFLOW
THICK OVERFLOW
PPM
1200
1000
800
600
400
200
0
8/22/92
8/29/92
9/5/92
9/12/92
9/19/92
9/26/92

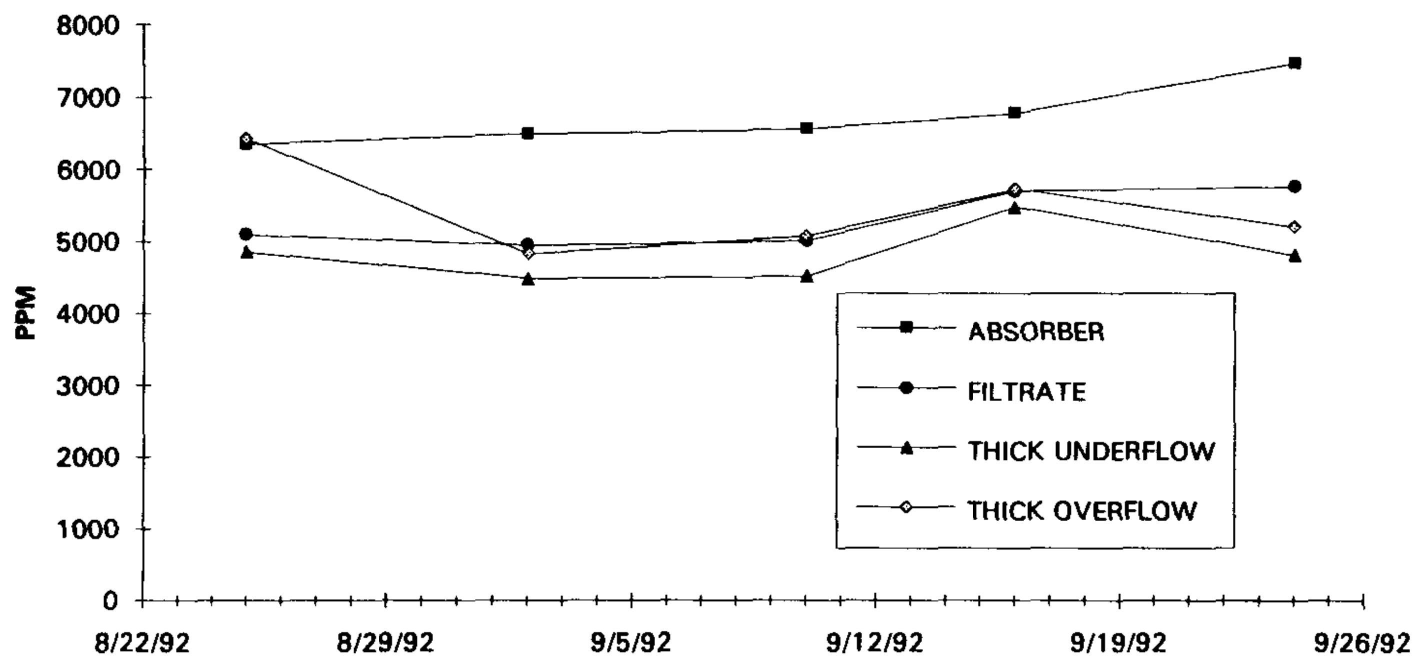

IRON
ABSORBER
FILTRATE
THICK UNDERFLOW
THICK OVERFLOW
PPM
1800
1600
1400
1200
1000
800
600
400
200
0
8/22/92
8/29/92
9/5/92
9/12/92
9/19/92
9/26/92



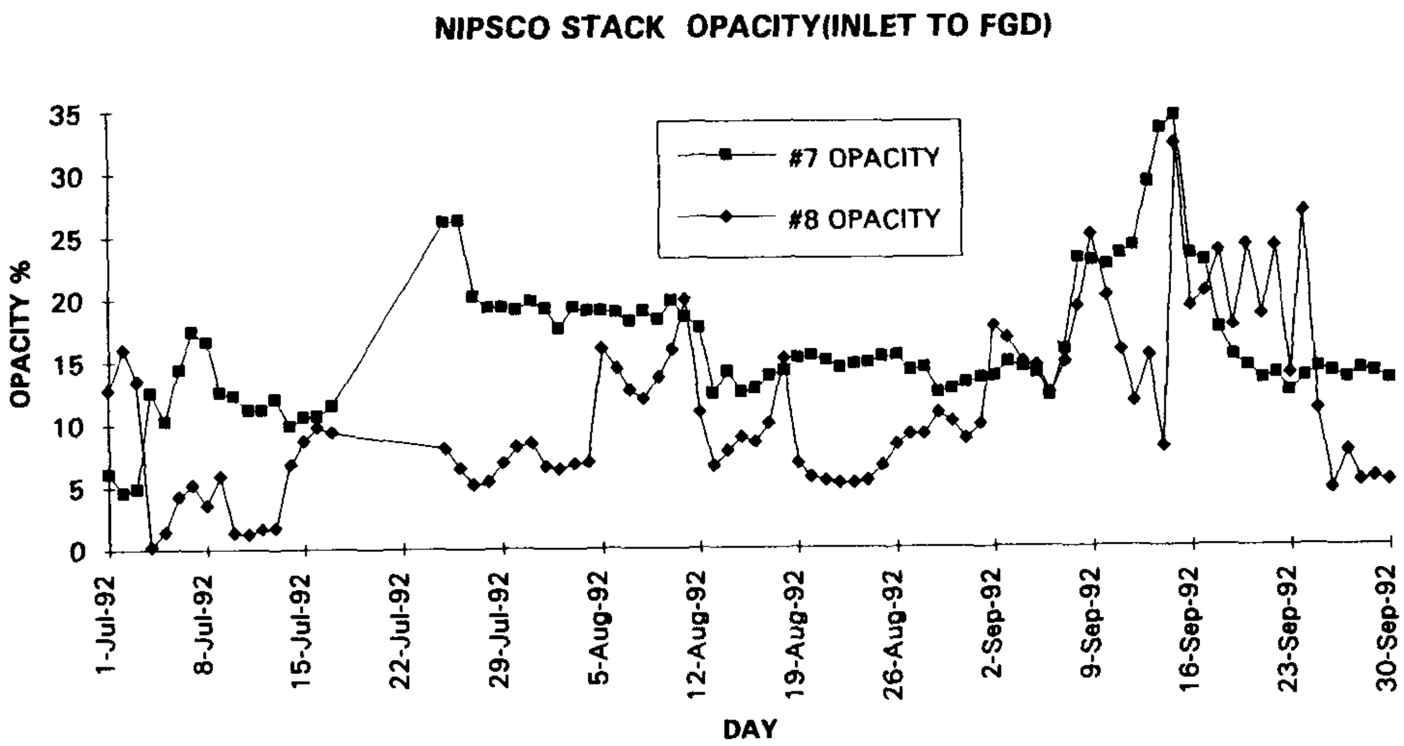
POTASSIUM
ABSORBER
THICK UNDERFLOW
THICK OVERFLOW
FILTRATE
PPM
300
250
200
150
100
50
0
8/22/92
8/29/92
9/5/92
9/12/92
9/19/92
9/26/92


SILICATES
ABSORBER
FILTRATE
THICK UNDERFLOW
THICK OVERFLOW
PPM
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
8/22/92
8/29/92
9/5/92
9/12/92
9/19/92
9/26/92

CHLORIDE



8000
7000
6000
5000
4000
3000
2000
1000
0
PPM
8/22/92
8/29/92
9/5/92
9/12/92
9/19/92
9/26/92
ABSORBER
FILTRATE
THICK UNDERFLOW
THICK OVERFLOW


NIPSCO STACK OPACITY(INLET TO FGD)
#7 OPACITY
#8 OPACITY
OPACITY %
35
30
25
20
15
10
5
0
1-Jul-92
8-Jul-92
15-Jul-92
22-Jul-92
29-Jul-92
5-Aug-92
12-Aug-92
19-Aug-92
26-Aug-92
2-Sep-92
9-Sep-92
16-Sep-92
23-Sep-92
30-Sep-92
DAY

SECTION 6.4 FLUE GAS TESTING RESULTS

DESCRIPTION OF INSTALLATION

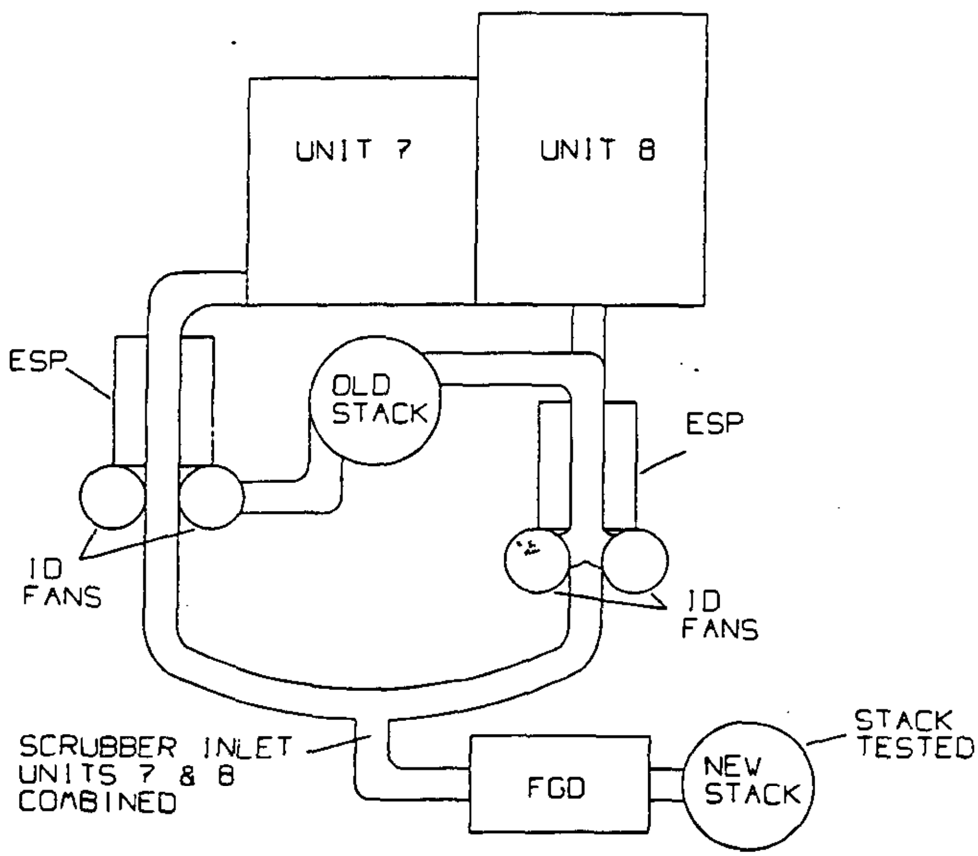
2-1

Pure Air was contracted to construct and operate the flue gas desulfurization process (FGD) at the NIPSCO-Bailly Station plant located near Chesterton, Indiana. The plant is equipped with two Babcock & Wilcox Coal-Fired Boiler Units, designated as Units 7 and 8, with respective rated capacities of 180 MW and 350 MW. Each unit has a Wheelabrator-Frye Cold Side electrostatic precipitator (ESP). The ESP outlets combine into one common Pure Air Wet Scrubber inlet.

Simultaneous testing was performed at the Units 7 and 8 Combined FGD Inlet and at the New Stack. All gas flow was directed through the FGD system during testing. No flow exited via the old stack.

Process operating data obtained during the test period was retained by Pure Air personnel.

A schematic of the process is shown below.



PURE AIR
CAE Project No: 6331

TABLE 1 - Summary of Test Results

EPA Method 5B
August 10 and 11, 1992

Run No.	1	2	3	4
Date (1992)	August 10	August 11	August 11	August 11
Start Time (approx.)	5:40 PM	8:10 AM	11:50 AM	3:45 PM
Stop Time (approx.)	8:06 PM	10:36 AM	2:25 PM	6:07 PM
Units 7 and 8 Combined FGD Inlet				
Gas Conditions				
Temperature (° F)	321	335	335	330
Moisture (volume %)	11.1	9.2	10.0	6.8
O_2 (dry volume %)	6.2	6.2	6.2	6.2
CO_2 (dry volume %)	12.8	12.8	12.8	12.8
Volumetric Flow Rate				
acfm	2,024,000	2,100,000	2,139,000	2,097,000
dscfm	1,212,000	1,261,000	1,274,000	1,301,000
Nonsulfuric Acid Particulate				
gr/dscf	0.0383	0.0381	0.0660	0.0236
lb/hr	398	412	721	263
lb/MBtu[1]	0.0760	0.0757	0.1310	0.0469
New Stack				
Gas Conditions				
Temperature (° F)	130	128	128	127
Moisture (volume %)[2]	15.3	14.7	14.7	14.3
O_2 (dry volume %)	6.8	6.6	6.6	6.6
CO_2 (dry volume %)	12.2	12.4	12.4	12.4
Volumetric Flow Rate				
acfm	1,749,000	1,762,000	1,790,000	1,812,000
dscfm	1,294,000	1,315,000	1,336,000	1,361,000
Nonsulfuric Acid Particulate				
gr/dscf	0.0063	0.0091	0.0072	0.0058
lb/hr	70.2	102.5	82.2	68.2
lb/MBtu[1]	0.0131	0.0186	0.0147	0.0119
Particulate Removal Efficiency				
percent, based on lb/MBtu	82.8	75.4	88.8	74.6

[1] As calculated with an Fd factor of 9,780.

[2] The gas stream for Runs 2, 3, and 4 at the New Stack was saturated. The saturation moisture values are used in all calculations. See Comments on page 4-1.

TABLE 2 - Summary of Test Results

EPA Method 5B
August 12, 1992

Run No.	5	6	7
Start Time (approx.)	8:40 AM	12:10 PM	5:15 PM
Stop Time (approx.)	11:02 AM	2:34 PM	7:43 PM
Units 7 and 8 Combined FGD Inlet			
Gas Conditions			
Temperature (° F)	326	323	318
Moisture (volume %)	8.6	6.0	8.2
O_2 (dry volume %)	6.0	6.4	6.1
CO_2 (dry volume %)	12.8	12.6	12.6
Volumetric Flow Rate			
acfm	2,022,000	1,964,000	2,064,000
dscfm	1,241,000	1,238,000	1,281,000
Nonsulfuric Acid Particulate			
gr/dscf	0.0654	0.0179	0.0140
lb/hr	695	190	154
lb/MBtu[1]	0.1281	0.0360	0.0276
New Stack			
Gas Conditions			
Temperature (° F)	127	127	127
Moisture (volume %)[2]	14.2	14.2	14.2
O_2 (dry volume %)	6.6	7.0	6.4
CO_2 (dry volume %)	12.4	12.0	12.4
Volumetric Flow Rate			
acfm	1,777,000	1,704,000	1,662,000
dscfm	1,342,000	1,287,000	1,255,000
Nonsulfuric Acid Particulate			
gr/dscf	0.0085	0.0093	0.0051
lb/hr	97.6	102.5	54.5
lb/MBtu[1]	0.0173	0.0195	0.0102
Particulate Removal Efficiency			
percent, based on lb/MBtu	86.5	45.8	63.0

[1] As calculated with an Fd factor of 9,780.
[2] The gas stream at the New Stack was saturated.
The saturation moisture values are used in all calculations. See Comments on page 4-1.

TABLE 3 - Summary of Test Results

EPA Method 5B
August 13, 1992

Run No.	8	9	10	AVERAGE
Start Time (approx.)	8:40 AM	1:22 PM	4:55 PM	
Stop Time (approx.)	11:07 AM	3:48 PM	7:16 PM	
Units 7 and 8 Combined FGD Inlet				
Gas Conditions				
Temperature (° F)	326	326	325	327
Moisture (volume %)	8.9	6.9	6.6	8.2
O_2 (dry volume %)	6.2	6.2	6.6	6.2
CO_2 (dry volume %)	12.6	12.6	12.4	12.7
Volumetric Flow Rate				
acfm	2,158,000	2,104,000	2,127,000	2,080,000
dscfm	1,319,000	1,314,000	1,333,000	1,277,000
Nonsulfuric Acid Particulate				
gr/dscf	0.0145	0.0293	0.0230	0.0325
lb/hr	164	330	263	359
lb/MBtu[1]	0.0288	0.0582	0.0470	0.0655
New Stack				
Gas Conditions				
Temperature (° F)	127	128	127	128
Moisture (volume %)[2]	14.3	14.0	14.3	14.4
O_2 (dry volume %)	6.4	6.2	6.4	6.6
CO_2 (dry volume %)	12.6	12.6	12.6	12.4
Volumetric Flow Rate				
acfm	1,807,000	1,843,000	1,739,000	1,765,000
dscfm	1,364,000	1,393,000	1,312,000	1,326,000
Nonsulfuric Acid Particulate				
gr/dscf	0.0080	0.0058	0.0061	0.0071
lb/hr	94.0	69.4	68.4	81.0
lb/MBtu[1]	0.0162	0.0115	0.0122	0.0145
Particulate Removal Efficiency				
percent, based on lb/MBtu	43.8	80.2	74.0	71.5

[1] As calculated with an Fd factor of 9,780.
[2] The gas stream for Runs 8 and 10 at the New Stack was saturated.
The saturation moisture values are used in all calculations. See Comments on page 4-1.

TABLE 4 - Summary of Test Results

EPA Methods 6 and 8
August 11 - 13, 1992

Run No.[1]	3	4	5	6	7	8	AVERAGE
Date (1992)	August 11	August 11	August 12	August 12	August 13	August 13	
Start Time (approx.)	8:15 AM	10:00 AM	2:25 PM	4:55 PM	1:45 PM	4:14 PM	
Stop Time (approx.)	9:15 AM	11:00 AM	3:25 PM	5:55 PM	2:45 PM	5:14 PM	
Units 7 and 8 Combined FGD Inlet							
Gas Conditions							
Temperature (°F)	355	355	345	345	345	345	348
Moisture (volume %)[2]	6.8	6.8	6.1	8.2	6.9	6.6	6.9
O_2 (dry volume %)[2]	6.2	6.2	6.4	6.1	6.2	6.6	6.3
CO_2 (dry volume %)[2]	12.8	12.8	12.6	12.6	12.6	12.4	12.6
Volumetric Flow Rate							
acfm	2,883,000	2,802,000	2,602,000	2,749,000	2,608,000	2,607,000	2,709,000
dscfm	1,730,000	1,683,000	1,602,000	1,654,000	1,591,000	1,595,000	1,643,000
Sulfur Dioxide							
lb/dscf	3.78E-04	3.73E-04	3.83E-04	3.41E-04	3.66E-04	3.53E-04	3.66E-04
ppm	2,277	2,244	2,303	2,050	2,201	2,121	2,199
lb/hr	39,290	37,670	36,600	33,830	34,920	33,750	36,040
lb/MBtu[3]	5.263	5.188	5.397	4.708	5.087	5.041	5.114
Sulfuric Acid Mist							
lb/dscf	11.2E-06	4.57E-06	8.37E-06	8.21E-06	8.15E-06	9.57E-06	8.35E-06
ppm	44	18	33	32	32	38	33
lb/hr	1,158	462	805	815	778	915	820
lb/MBtu[3]	0.1551	0.0636	0.1180	0.1134	0.1133	0.1367	0.1167
New Stack							
Gas Conditions							
Temperature (°F)	128	128	127	127	128	128	128
Moisture (volume %)[2]	14.3	14.3	14.2	14.2	14.0	14.3	14.2
O_2 (dry volume %)[2]	6.6	6.6	7.0	6.4	6.2	6.4	6.5
CO_2 (dry volume %)[2]	12.4	12.4	12.0	12.4	12.6	12.6	12.4
Volumetric Flow Rate							
acfm	1,608,000	1,562,000	1,520,000	1,465,000	1,630,000	1,551,000	1,556,000
dscfm	1,206,000	1,171,000	1,146,000	1,106,000	1,232,000	1,169,000	1,172,000
Sulfur Dioxide							
lb/dscf	3.53E-05	3.23E-05	2.83E-05	3.12E-05	3.18E-05	3.48E-05	3.23E-05
ppm	212	194	170	188	191	209	194
lb/hr	2,558	2,271	1,951	2,069	2,352	2,439	2,270
lb/MBtu[3]	0.5049	0.4620	0.4166	0.4396	0.4425	0.4902	0.4593
Sulfuric Acid Mist							
lb/dscf	3.14E-08	2.74E-08	5.81E-08	4.14E-08	7.18E-08	7.59E-08	5.10E-08
ppm	12	11	23	16	28	30	20
lb/hr	227	193	400	275	531	532	360
lb/MBtu[3]	0.0449	0.0392	0.0855	0.0584	0.0998	0.1070	0.0726
Sulfur Dioxide Removal Efficiency							
percent, based on lb/MBtu	90.4	91.1	92.3	90.7	91.3	90.3	91.0
Sulfuric Acid Mist Removal Efficiency							
percent, based on lb/MBtu	71.1	38.4	27.5	48.5	11.9	21.7	36.5

[1] *Runs 1 and 2 were not acceptable. See Comments on page 4-1.*

[2] Moisture, O_2, and CO_2 values for Runs 3 and 4 were obtained from Run 4 of the particulate testing. See Comments on page 4-1.
Moisture, O_2, and CO_2 values for Runs 5 and 6 were obtained from Runs 6 and 7 of the particulate testing, respectively.
Moisture, O_2, and CO_2 values for Runs 7 and 8 were obtained from Runs 9 and 10 of the particulate testing, respectively.

[3] As calculated with an Fd factor of 9,780.

TABLE 5 - Summary of Test Results

EPA Method 6C
August 11, 1992

Run No.	1	2	3
Start Time (approx.)	10:05 AM	11:20 AM	12:32 PM
Stop Time (approx.)	11:05 AM	12:20 PM	1:32 PM
Units 7 and 8 Combined FGD Inlet			
Gas Conditions[1]			
Temperature (° F)	335	335	335
Moisture (volume %)	9.2	10.0	10.0
O_2 (dry volume %)	6.2	6.2	6.2
CO_2 (dry volume %)	12.8	12.8	12.8
Volumetric Flow Rate[1]			
acfm	2,100,000	2,139,000	2,139,000
dscfm	1,261,000	1,274,000	1,274,000
Sulfur Dioxide			
ppm	2,138	2,180	2,210
lb/hr	26,900	27,720	28,090
lb/MBtu[2]	4.944	5.042	5.110
New Stack			
Gas Conditions[1]			
Temperature (° F)	128	128	128
Moisture (volume %)	14.7	14.7	14.7
O_2 (dry volume %)	6.6	6.6	6.6
CO_2 (dry volume %)	12.4	12.4	12.4
Volumetric Flow Rate[1]			
acfm	1,762,000	1,790,000	1,790,000
dscfm	1,315,000	1,336,000	1,336,000
Sulfur Dioxide			
ppm	176	161	162
lb/hr	2,310	2,140	2,160
lb/MBtu[2]	0.4185	0.3816	0.3852
Sulfur Dioxide Removal Efficiency			
percent, based on lb/MBtu	91.5	92.4	92.5

[1] The gas conditions and volumetric flow rates for Run 1 were obtained from Particulate Run 2. The gas conditions and volumetric flow rates for Runs 2 and 3 were obtained from Particulate Run 3. See Comments on page 4-1.

[2] As calculated with an Fd factor of 9,780.

TABLE 6 - Summary of Test Results

EPA Method 6C
August 12, 1992

Run No.	4	5	6
Start Time (approx.)	8:30 AM	10:20 AM	11:35 AM
Stop Time (approx.)	9:30 AM	11:20 AM	12:35 PM
Units 7 and 8 Combined FGD Inlet			
Gas Conditions[1]			
Temperature (° F)	326	326	323
Moisture (volume %)	8.6	8.6	6.0
O_2 (dry volume %)	6.0	6.0	6.4
CO_2 (dry volume %)	12.8	12.8	12.6
Volumetric Flow Rate[1]			
acfm	2,022,000	2,022,000	1,964,000
dscfm	1,241,000	1,241,000	1,238,000
Sulfur Dioxide			
ppm	2,217	2,253	2,252
lb/hr	27,450	27,890	27,820
lb/MBtu[2]	5.057	5.138	5.280
New Stack			
Gas Conditions[1]			
Temperature (° F)	127	127	127
Moisture (volume %)	14.2	14.2	14.2
O_2 (dry volume %)	6.6	6.6	7.0
CO_2 (dry volume %)	12.4	12.4	12.0
Volumetric Flow Rate[1]			
acfm	1,777,000	1,777,000	1,704,000
dscfm	1,342,000	1,342,000	1,287,000
Sulfur Dioxide			
ppm	180	155	139
lb/hr	2,420	2,080	1,780
lb/MBtu[2]	0.4296	0.3692	0.3390
Sulfur Dioxide Removal Efficiency			
percent, based on lb/MBtu	91.5	92.8	93.6

[1] The gas conditions and volumetric flow rates for Runs 4 and 5 were obtained from Particulate Run 5. The gas conditions and volumetric flow rates for Run 6 were obtained from Particulate Run 6. See Comments on page 4-1.

[2] As calculated with an Fd factor of 9,780.

TABLE 7 - Summary of Test Results

EPA Method 6C
August 13, 1992

Run No.	7	8	9	AVERAGE
Start Time (approx.)	8:30 AM	10:22 AM	11:37 AM	
Stop Time (approx.)	9:30 AM	11:22 AM	12:37 PM	
Units 7 and 8 Combined FGD Inlet				
Gas Conditions[1]				
Temperature (° F)	326	326	326	329
Moisture (volume %)	8.9	8.9	8.9	8.8
O_2 (dry volume %)	6.2	6.2	6.2	6.2
CO_2 (dry volume %)	12.6	12.6	12.6	12.7
Volumetric Flow Rate[1]				
acfm	2,158,000	2,158,000	2,158,000	2,096,000
dscfm	1,319,000	1,319,000	1,319,000	1,276,000
Sulfur Dioxide				
ppm	2,270	2,273	2,298	2,232
lb/hr	29,870	29,920	30,240	28,433
lb/MBtu[2]	5.248	5.257	5.313	5.154
New Stack				
Gas Conditions[1]				
Temperature (° F)	127	127	127	127
Moisture (volume %)	14.3	14.3	14.3	14.4
O_2 (dry volume %)	6.4	6.4	6.4	6.6
CO_2 (dry volume %)	12.6	12.6	12.6	12.4
Volumetric Flow Rate[1]				
acfm	1,807,000	1,807,000	1,807,000	1,780,000
dscfm	1,364,000	1,364,000	1,364,000	1,339,000
Sulfur Dioxide				
ppm	151	170	154	161
lb/hr	2,060	2,320	2,100	2,152
lb/MBtu[2]	0.3548	0.3996	0.3617	0.3821
Sulfur Dioxide Removal Efficiency				
percent, based on lb/MBtu	93.2	92.4	93.2	92.6

[1] The gas conditions and volumetric flow rates for Runs 7, 8, and 9 were obtained from Particulate Run 8. See Comments on page 4-1.

[2] As calculated with an Fd factor of 9,780.

TABLE 8 - Summary of Test Results

EPA Method 7E
August 11, 1992

Run No.	1	2	3
Start Time (approx.)	10:05 AM	11:20 AM	12:32 PM
Stop Time (approx.)	11:05 AM	12:20 PM	1:32 PM
Units 7 and 8 Combined FGD Inlet			
Gas Conditions[1]			
Temperature (° F)	335	335	335
Moisture (volume %)	9.2	10.0	10.0
O_2 (dry volume %)	6.2	6.2	6.2
CO_2 (dry volume %)	12.8	12.8	12.8
Volumetric Flow Rate[1]			
acfm	2,100,000	2,139,000	2,139,000
dscfm	1,261,000	1,274,000	1,274,000
Nitrogen Oxides			
ppm	1,027	1,129	1,191
lb/hr	9,278	10,300	10,870
lb/MBtu[2]	1.705	1.874	1.977
New Stack			
Gas Conditions[1]			
Temperature (° F)	128	128	128
Moisture (volume %)	14.7	14.7	14.7
O_2 (dry volume %)	6.6	6.6	6.6
CO_2 (dry volume %)	12.4	12.4	12.4
Volumetric Flow Rate[1]			
acfm	1,762,000	1,790,000	1,790,000
dscfm	1,315,000	1,336,000	1,336,000
Nitrogen Oxides			
ppm	821	899	949
lb/hr	7,734	8,606	9,078
lb/MBtu[2]	1.401	1.535	1.619
Nitrogen Oxides Removal Efficiency			
percent, based on lb/MBtu	17.8	18.1	18.1

[1] The gas conditions and volumetric flow rates for Run 1 were obtained from Particulate Run 2. The gas conditions and volumetric flow rates for Runs 2 and 3 were obtained from Particulate Run 3. See Comments on page 4-1.
[2] As calculated with an Fd factor of 9,780.

TABLE 9 - Summary of Test Results

EPA Method 7E
August 12, 1992

Run No.	4	5	6
Start Time (approx.)	8:30 AM	10:20 AM	11:35 AM
Stop Time (approx.)	9:30 AM	11:20 AM	12:35 PM
Units 7 and 8 Combined FGD Inlet			
Gas Conditions[1]			
Temperature (° F)	326	326	323
Moisture (volume %)	8.6	8.6	6.0
O_2 (dry volume %)	6.0	6.0	6.4
CO_2 (dry volume %)	12.8	12.8	12.6
Volumetric Flow Rate[1]			
acfm	2,022,000	2,022,000	1,964,000
dscfm	1,241,000	1,241,000	1,238,000
Nitrogen Dioxide			
ppm	1,135	1,174	1,026
lb/hr	10,090	10,430	9,100
lb/MBtu[2]	1.859	1.922	1.727
New Stack			
Gas Conditions[1]			
Temperature (° F)	127	127	127
Moisture (volume %)	14.2	14.2	14.2
O_2 (dry volume %)	6.6	6.6	7.0
CO_2 (dry volume %)	12.4	12.4	12.0
Volumetric Flow Rate[1]			
acfm	1,777,000	1,777,000	1,704,000
dscfm	1,342,000	1,342,000	1,287,000
Nitrogen Dioxide			
ppm	950	896	859
lb/hr	9,131	8,613	7,915
lb/MBtu[2]	1.621	1.529	1.507
Nitrogen Dioxide Removal Efficiency			
percent, based on lb/MBtu	12.8	20.4	12.7

[1] The gas conditions and volumetric flow rates for Runs 4 and 5 were obtained from Particulate Run 5. The gas conditions and volumetric flow rates for Run 6 were obtained from Particulate Run 6. See Comments on page 4-1.

[2] As calculated with an Fd factor of 9,780.

TABLE 10 - Summary of Test Results

EPA Method 7E
August 13, 1992

Run No.	7	8	9	AVERAGE
Start Time (approx.)	8:30 AM	10:22 AM	11:37AM	
Stop Time (approx.)	9:30 AM	11:22 AM	12:37 PM	
Units 7 and 8 Combined FGD Inlet				
Gas Conditions[1]				
Temperature (° F)	326	326	326	**329**
Moisture (volume %)	8.9	8.9	8.9	**8.8**
O_2 (dry volume %)	6.2	6.2	6.2	**6.2**
CO_2 (dry volume %)	12.6	12.6	12.6	**12.7**
Volumetric Flow Rate[1]				
acfm	2,158,000	2,158,000	2,158,000	**2,096,000**
dscfm	1,319,000	1,319,000	1,319,000	**1,276,000**
Nitrogen Dioxide				
ppm	1,156	1,143	1,205	**1,132**
lb/hr	10,920	10,800	11,390	**10,353**
lb/MBtu[2]	1.919	1.898	2.001	**1.876**
New Stack				
Gas Conditions[1]				
Temperature (° F)	127	127	127	**127**
Moisture (volume %)	14.3	14.3	14.3	**14.4**
O_2 (dry volume %)	6.4	6.4	6.4	**6.6**
CO_2 (dry volume %)	12.6	12.6	12.6	**12.4**
Volumetric Flow Rate[1]				
acfm	1,807,000	1,807,000	1,807,000	**1,780,000**
dscfm	1,364,000	1,364,000	1,364,000	**1,339,000**
Nitrogen Dioxide				
ppm	803	780	822	**864**
lb/hr	7,846	7,625	8,032	**8,287**
lb/MBtu[2]	1.351	1.313	1.383	**1.473**
Nitrogen Dioxide Removal Efficiency				
percent, based on lb/MBtu	29.6	30.8	30.9	**21.3**

[1] The gas conditions and volumetric flow rates for Runs 7, 8 and 9 were obtained from Particulate Run 8. See Comments on page 4-1.

[2] As calculated with an Fd factor of 9,780.

TABLE 11 - Summary of Test Results

EPA Method 26
August 11 - 13, 1992

Run No.[1]	3	4	5	6	8	9	AVERAGE
Date (1992)	*August 11*	*August 11*	*August 12*	*August 12*	*August 13*	*August 13*	
Start Time (approx.)	11:50 AM	3:45 PM	8:40 AM	12:10 PM	8:40 AM	1:22 PM	
Stop Time (approx.)	2:25 PM	6:07 PM	11:02 AM	2:34 PM	11:07 AM	3:46 PM	
Units 7 and 8 Combined FGD Inlet							
Gas Conditions[2]							
Temperature (° F)	335	330	326	323	326	326	328
Moisture (volume %)	10.0	6.8	8.6	6.0	8.9	6.9	7.9
O_2 (dry volume %)	6.2	6.2	6.0	6.4	6.2	6.2	6.2
CO_2 (dry volume %)	12.8	12.8	12.8	12.6	12.6	12.6	12.7
Volumetric Flow Rate[2]							
acfm	2,139,000	2,097,000	2,022,000	1,964,000	2,158,000	2,104,000	2,081,000
dscfm	1,274,000	1,301,000	1,241,000	1,238,000	1,319,000	1,314,000	1,281,000
Hydrogen Chloride							
lb/dscf	2.31E-06	2.10E-06	4.27E-06	2.69E-06	4.40E-06	3.27E-06	3.17E-06
ppm	24	22	45	28	46	35	33
mg/dscm	36.9	33.6	68.4	43.1	70.4	52.4	50.8
lb/hr	176	164	318	200	348	258	244
lb/MBtu[3]	0.0321	0.0291	0.0586	0.0380	0.0611	0.0455	0.0441
Hydrogen Fluoride							
lb/dscf	3.21E-07	3.03E-07	7.25E-07	2.83E-07	6.91E-07	5.15E-07	4.73E-07
ppm	6	6	14	5	13	10	9
mg/dscm	5.14	4.85	11.6	4.53	11.1	8.25	7.57
lb/hr	24.5	23.7	54.0	21.0	54.7	40.6	36.4
lb/MBtu[3]	0.0046	0.0042	0.0099	0.0040	0.0096	0.0072	0.0066
New Stack							
Gas Conditions[2]							
Temperature (° F)	128	127	127	127	127	128	127
Moisture (volume %)	14.7	14.3	14.2	14.2	14.3	14.0	14.3
O_2 (dry volume %)	6.6	6.6	6.6	7.0	6.4	6.2	6.5
CO_2 (dry volume %)	12.4	12.4	12.4	12.0	12.6	12.6	12.4
Volumetric Flow Rate[2]							
acfm	1,790,000	1,812,000	1,777,000	1,704,000	1,807,000	1,843,000	1,789,000
dscfm	1,336,000	1,361,000	1,342,000	1,287,000	1,364,000	1,393,000	1,347,000
Hydrogen Chloride							
lb/dscf	0.907E-07	1.04E-07	0.804E-07	1.88E-07	2.04E-07	1.54E-07	1.37E-07
ppm	1	1	1	2	2	2	1
mg/dscm	1.45	1.67	1.29	3.01	3.27	2.46	2.19
lb/hr	6.93	8.15	5.98	14.0	16.2	12.1	10.6
lb/MBtu[3]	0.0013	0.0015	0.0012	0.0028	0.0029	0.0021	0.0020
Hydrogen Fluoride							
lb/dscf	<3.35E-09	<3.31E-09	<3.47E-09	<3.53E-09	<3.23E-09	<3.30E-09	<3.37E-09
ppm[4]	<1	<1	<1	<1	<1	<1	<1
mg/dscm	<0.054	<0.053	<0.056	<0.057	<0.052	<0.053	<0.054
lb/hr	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26
lb/MBtu[3]	<4.78E-05	<4.73E-05	<4.95E-05	<5.19E-05	<4.55E-05	<4.59E-05	<4.80E-05
Hydrogen Chloride Removal Efficiency							
percent, based on lb/MBtu	96.0	94.9	98.0	92.7	95.3	95.3	95.4
Hydrogen Fluoride Removal Efficiency							
percent, based on lb/MBtu	98.9	98.9	99.5	98.7	99.5	99.4	99.1

[1] Runs 1, 2, and 7 were not analyzed for chloride or fluoride. See Comments on page 4-1.

[2] All gas conditions and flow rates were obtained from their respective simultaneous particulate runs (ex: Chloride/Fluoride Run 3 conditions = Particulate Run 3 conditions).

[3] As calculated with an Fd factor of 9,780.

[4] The fluoride measurements at the New Sta

TABLE 1 - Summary of Test Results

EPA Method 5B
August 26, 1992

Units 7 and 8 Combined FGD Inlet

Run No.	11	12	13	Average
Start Time (approx.)	1:17 PM	6:07 PM	9:37 PM	
Stop Time (approx.)	3:52 PM	7:51 PM	11:20 PM	
Gas Conditions				
Temperature (° F)	297	295	293	295
Moisture (volume %)	5.1	7.1	10.1	7.4
O_2 (dry volume %)	8.9	7.0	7.0	7.6
CO_2 (dry volume %)	10.6	12.0	12.0	11.5
Volumetric Flow Rate				
acfm	845,100	782,600	738,400	788,700
dscfm	548,300	498,500	456,100	501,000
Particulate				
gr/dscf	0.0441	0.0106	0.0132	0.0236
lb/hr	207	45.4	51.5	101
lb/MBtu[1]	0.1073	0.0223	0.0277	0.0524

New Stack

Run No.	11	12	13	Average
Start Time (approx.)	1:17 PM	6:10 PM	9:40 PM	
Stop Time (approx.)	3:31 PM	8:20 PM	11:52 PM	
Gas Conditions				
Temperature (° F)	129	128	129	129
Moisture (volume %)[2]	15.1	12.5	13.2	13.6
O_2 (dry volume %)	9.4	7.2	7.0	7.9
CO_2 (dry volume %)	10.2	11.8	12.0	11.3
Volumetric Flow Rate				
acfm	587,200	641,800	579,700	602,900
dscfm	435,500	490,800	439,500	455,300
Particulate				
gr/dscf	0.0128	0.0069	0.0067	0.0087
lb/hr	47.8	29.1	25.2	34.0
lb/MBtu[1]	0.0325	0.0147	0.0140	0.0204
Particulate Removal Efficiency				
Percent, based on lb/MBtu	69.71	34.08	49.46	51.08

[1] As calculated with an Fd factor of 9,780.
[2] The gas flow during Run 11 at the Stack was saturated.
The saturated moisture value was used in all calculations. See Comments on page [illegible].

TABLE 2 - Summary of Test Results

EPA Method 6C
August 26, 1992

Units 7 and 8 Combined FGD Inlet

Run No.	10	11	12	Average
Start Time (approx.)	1:17 PM	5:48 PM	9:37 PM	
Stop Time (approx.)	2:27 PM	6:48 PM	10:38 PM	
Gas Conditions				
Temperature (° F)	297	295	293	295
Moisture (volume %)	5.1	7.1	10.1	7.4
O_2 (dry volume %)	8.9	7.0	7.0	7.6
CO_2 (dry volume %)	10.6	12.0	12.0	11.5
Volumetric Flow Rate				
acfm	845,100	782,600	738,400	788,700
dscfm	548,300	498,500	456,100	501,000
Sulfur Dioxide				
ppm	2,145	2,091	2,116	2,118
lb/hr	11,700	10,400	9,620	10,600
lb/MBtu[1]	6.068	5.106	5.170	5.448

New Stack

Run No.	10	11	12	Average
Start Time (approx.)	1:17 PM	5:51 PM	9:39 PM	
Stop Time (approx.)	2:17 PM	6:51 PM	10:39 PM	
Gas Conditions				
Temperature (° F)	129	128	129	129
Moisture (volume %)[2]	15.1	12.5	13.2	13.6
O_2 (dry volume %)	9.4	7.2	7.0	7.9
CO_2 (dry volume %)	10.2	11.8	12.0	11.3
Volumetric Flow Rate				
acfm	587,200	641,800	579,700	602,900
dscfm	435,500	490,800	439,500	455,300
Sulfur Dioxide				
ppm	23	22	10	18
lb/hr	101	106	44.0	83.7
lb/MBtu[1]	0.0684	0.0536	0.0244	0.0488
Sulfur Dioxide Removal Efficiency				
Percent, based on lb/MBtu	98.87	98.95	99.53	99.12

[1] As calculated with an Fd factor of 9,780.
[2] The gas flow during Run 10 of sulfur dioxide testing at the Stack was saturated. The saturated moisture value was used in all calculations. See Comments on page 4-1.

TABLE 3 - Summary of Test Results

EPA Method 7E
August 26, 1992

Units 7 and 8 Combined FGD Inlet

Run No.[1]	10
Start Time (approx.)	1:17 PM
Stop Time (approx.)	1:56 PM
Gas Conditions	
Temperature (° F)	297
Moisture (volume %)	5.1
O_2 (dry volume %)	8.9
CO_2 (dry volume %)	10.6
Volumetric Flow Rate	
acfm	845,100
dscfm	548,300
Nitrogen Oxides	
ppm	651
lb/hr	2,560
lb/MBtu[2]	1.3255

New Stack

Run No.	10	11	12	Average
Start Time (approx.)	1:17 PM	5:51 PM	9:39 PM	
Stop Time (approx.)	2:17 PM	6:51 PM	10:39 PM	
Gas Conditions				
Temperature (° F)	129	128	129	129
Moisture (volume %)[3]	15.1	12.5	13.2	13.6
O_2 (dry volume %)	9.4	7.2	7.0	7.9
CO_2 (dry volume %)	10.2	11.8	12.0	11.3
Volumetric Flow Rate				
acfm	587,200	641,800	579,700	602,900
dscfm	435,500	490,800	439,500	455,300
Nitrogen Oxides				
ppm	597	595	600	597
lb/hr	1,860	2,090	1,890	1,950
lb/MBtu[2]	1.2652	1.0589	1.0540	1.13
Nitrogen Oxides Removal Efficiency				
Percent, based on lb/MBtu	4.55			

[1] See Comments on page 4-1.
[2] As calculated with an Fd factor of 9,780.
[3] The gas flow during Run 10 of sulfur dioxide testing at the Stack was saturated. The saturated moisture value was used in all calculations. See Comments on page 4-1.

TABLE 4 - Summary of Test Results

EPA Method 8
Sulfur Dioxide
August 27, 1992

Units 7 and 8 Combined FGD Inlet

Run No.	9	10	Average
Start Time (approx.)	12:13 AM	1:54 AM	
Stop Time (approx.)	1:16 AM	2:54 AM	
Gas Conditions			
Temperature (° F)	290	288	289
Moisture (volume %)[1]	10.1	10.1	10.1
O_2 (dry volume %)[1]	7.0	7.0	7.0
CO_2 (dry volume %)[1]	12.0	12.0	12.0
Volumetric Flow Rate			
acfm[1]	738,400	738,400	738,400
dscfm[1]	456,100	456,100	456,100
Sulfur Dioxide			
ppm	2,132	2,007	2,070
lb/hr	9,700	9,130	9,420
lb/MBtu[2]	5.213	4.907	5.060

New Stack

Run No.	9	10	Average
Start Time (approx.)	12:12 AM	1:54 AM	
Stop Time (approx.)	1:12 AM	2:54 AM	
Gas Conditions			
Temperature (° F)	129	129	129
Moisture (volume %)[1]	13.2	13.2	13.2
O_2 (dry volume %)[1]	7.0	7.0	7.0
CO_2 (dry volume %)[1]	12.0	12.0	12.0
Volumetric Flow Rate			
acfm[1]	579,700	579,700	579,700
dscfm[1]	439,500	439,500	439,500
Sulfur Dioxide			
ppm	13	3	8
lb/hr	56.2	14.6	35.4
lb/MBtu[2]	0.031	0.008	0.020
Sulfur Dioxide Removal Efficiency			
Percent, based on lb/MBtu	99.41	99.84	99.62

[1] See Comments on page 4-1.
[2] As calculated with an Fd factor of 9,780.

TABLE 5 - Summary of Test Results

EPA Method 8
Sulfuric Acid Mist (including Sulfur Trioxide)
August 27, 1992

Units 7 and 8 Combined FGD Inlet

Run No.	9	10	Average
Start Time (approx.)	12:13 AM	1:54 AM	
Stop Time (approx.)	1:16 AM	2:54 AM	
Gas Conditions			
Temperature (°F)	290	288	289
Moisture (volume %)[1]	10.1	10.1	10.1
O_2 (dry volume %)[1]	7.0	7.0	7.0
CO_2 (dry volume %)[1]	12.0	12.0	12.0
Volumetric Flow Rate			
acfm[1]	738,400	738,400	738,400
dscfm[1]	456,100	456,100	456,100
Sulfuric Acid Mist (Including SO_3)			
ppm	13	15	14
lb/hr	89.5	101	95.4
lb/MBtu[2]	0.048	0.054	0.051

New Stack

Run No.	9	10	Average
Start Time (approx.)	12:12 AM	1:54 AM	
Stop Time (approx.)	1:12 AM	2:54 AM	
Gas Conditions			
Temperature (°F)	129	129	129
Moisture (volume %)[1]	13.2	13.2	13.2
O_2 (dry volume %)[1]	7.0	7.0	7.0
CO_2 (dry volume %)[1]	12.0	12.0	12.0
Volumetric Flow Rate			
acfm[1]	579,700	579,700	579,700
dscfm[1]	439,500	439,500	439,500
Sulfuric Acid Mist (Including SO_3)			
ppm	11	7	9
lb/hr	73.8	44.5	59.1
lb/MBtu[2]	0.041	0.025	0.033
Sulfuric Acid Mist Removal Efficiency			
Percent, based on lb/MBtu	14.58	53.70	34.14

[1] See Comments on page 4-1.
[2] As calculated with an Fd factor of 9,780.

TABLE 6 - Summary of Test Results

EPA Method 26
Hydrogen Chloride
August 26, 1992

Units 7 and 8 Combined FGD Inlet

Run No.	12	13	Average
Start Time (approx.)	6:07 PM	9:37 PM	
Stop Time (approx.)	7:51 PM	11:20 PM	
Gas Conditions[1]			
Temperature (° F)	295	293	294
Moisture (volume %)	7.1	10.1	8.6
O_2 (dry volume %)	7.0	7.0	7.0
CO_2 (dry volume %)	12.0	12.0	12.0
Volumetric Flow Rate[1]			
acfm	782,600	738,400	760,500
dscfm	498,500	456,100	477,300
Hydrogen Chloride			
ppm	63.9	78.1	71.0
lb/hr	181	202	192
lb/MBtu[2]	0.1389	0.1698	0.1544

New Stack

Run No.	12	13	Average
Start Time (approx.)	6:10 PM	9:40 PM	
Stop Time (approx.)	8:20 PM	11:52 PM	
Gas Conditions[1]			
Temperature (° F)	128	129	129
Moisture (volume %)	12.5	13.2	12.9
O_2 (dry volume %)	7.2	7.0	7.1
CO_2 (dry volume %)	11.8	12.0	11.9
Volumetric Flow Rate[1]			
acfm	641,800	579,700	610,750
dscfm	490,800	439,500	465,200
Hydrogen Chloride			
ppm	0.475	0.234	0.355
lb/hr	1.32	0.585	0.955
lb/MBtu[2]	1.01E-03	5.09E-04	7.60E-04
Hydrogen Chloride Removal Efficiency			
Percent, based on lb/MBtu	99.27	99.70	99.49

[1] Data was obtained from concurrent particulate testing.
[2] As calculated with an Fd factor of 9,780.

TABLE 7 - Summary of Test Results

EPA Method 26
Hydrogen Fluoride
August 26, 1992

Units 7 and 8 Combined FGD Inlet

Run No.	12	13	Average
Start Time (approx.)	6:07 PM	9:37 PM	
Stop Time (approx.)	7:51 PM	11:20 PM	
Gas Conditions[1]			
Temperature (° F)	295	293	294
Moisture (volume %)	7.1	10.1	8.6
O_2 (dry volume %)	7.0	7.0	7.0
CO_2 (dry volume %)	12.0	12.0	12.0
Volumetric Flow Rate[1]			
acfm	782,600	738,400	760,500
dscfm	498,500	456,100	477,300
Hydrogen Fluoride			
ppm	11.2	13.4	12.3
lb/hr	17.4	19.0	18.2
lb/MBtu[2]	0.0244	0.0290	0.0267

New Stack

Run No.	12	13	Average
Start Time (approx.)	6:10 PM	9:40 PM	
Stop Time (approx.)	8:20 PM	11:52 PM	
Gas Conditions[1]			
Temperature (° F)	128	129	129
Moisture (volume %)	12.5	13.2	12.9
O_2 (dry volume %)	7.2	7.0	7.1
CO_2 (dry volume %)	11.8	12.0	11.9
Volumetric Flow Rate[1]			
acfm	641,800	579,700	610,750
dscfm	490,800	439,500	465,200
Hydrogen Fluoride			
ppm	<0.034	<0.039	<0.037
lb/hr	<0.052	<0.054	<0.053
lb/MBtu[2]	<7.16E-05	<8.50E-05	<7.83E-05
Hydrogen Fluoride Removal Efficiency			
Percent, based on lb/MBtu	>99.71	>99.71	>99.71

[1] Data was obtained from concu
[2] As calculated with an Fd factoı

TABLE 1 - Summary of Test Results

EPA Method 5B
Particulate
Units 7 and 8 Combined FGD Inlet and New Stack

348 M.W.

Run No.[1]	14	15[2]	16A[2]	ADJUSTED[2] 16A	AVERAGE based on adjusted flows
Date (1992)	September 16	September 16	September 17		
Start Time (approx.)	2:15 PM	6:30 PM	12:49 PM		
Stop Time (approx.)	5:34 PM	8:51 PM	3:28 PM		
Unit 8 Process Conditions					
Power Output (MW)	345	345	345	345	
Units 7 and 8 Combined FGD Inlet					
Gas Conditions					
Temperature (°F)	331	331	331	331	331
Moisture (volume %)	8.4	6.6	7.7	7.7	7.6
O_2 (dry volume %)	6.6	6.2	7.0	7.0	6.6
CO_2 (dry volume %)	12.4	12.6	12.0	12.0	12.3
Volumetric Flow Rate					
acfm	1,304,000	1,324,000	1,910,000[2]	1,220,000[2]	1,283,000
dscfm	792,700	820,800	1,157,000	885,500	833,000
Particulate					
gr/dscf	0.0362	N/A[3]	0.0362[2]	0.0362[2]	0.0362
lb/hr	246	N/A[3]	359	275	174
lb/MBtu[4]	0.0740	N/A[3]	0.0761	0.0761	0.0751
New Stack					
Gas Conditions					
Temperature (°F)	128	130	133	133	130
Moisture (volume %)[2]	14.7	14.4	16.2	16.2	15.1
O_2 (dry volume %)	6.8	6.6	7.2	7.2	6.9
CO_2 (dry volume %)	12.2	12.4	12.0	12.0	12.2
Volumetric Flow Rate					
acfm	1,182,000	1,025,000	1,238,000	1,238,000	1,148,000
dscfm	883,300	765,100	898,400	898,400	848,900
Particulate					
gr/dscf	0.0096	0.0094	0.0058	0.0058	0.0082
lb/hr	72.4	61.8	44.9	44.9	59.7
lb/MBtu[4]	0.0198	0.0192	0.0124	0.0124	0.0171
Particulate Removal Efficiency					
percent, based on lb/MBtu	73.2	N/A[3]	83.7	83.7	80.2

[1] Runs 1-13 were issued in previous reports.
[2] See Comments on page 4-1 for discussion of Run 16A.
[3] See Comments on page 4-1 for discussion of Run 15.
[4] As calculated with an Fd factor of 9,780.

TABLE 2 - Summary of Test Results

EPA Method 6C
Sulfur Dioxide
Units 7 and 8 Combined FGD Inlet and New Stack

Run No.[1]	13	14	15	AVERAGE
Date (1992)	September 16	September 16	September 16	
Start Time (approx.)	2:15 PM	3:42 PM	5:55 PM	
Stop Time (approx.)	3:15 PM	4:42 PM	6:55 PM	
Unit 8 Process Conditions				
Power Output (MW)	345	345	345	
Units 7 and 8 Combined FGD Inlet				
Gas Conditions[2]				
Temperature (°F)	331	331	331	331
Moisture (volume %)	8.4	8.4	6.6	7.8
O_2 (dry volume %)	6.6	6.6	6.2	6.5
CO_2 (dry volume %)	12.4	12.4	12.6	12.5
Volumetric Flow Rate[2]				
acfm	1,304,000	1,304,000	1,324,000	1,311,000
dscfm	792,700	792,700	820,800	802,100
Sulfur Dioxide				
ppm	2,277	2,323	2,281	2,294
lb/hr	18,010	18,370	18,680	18,350
lb/MBtu[3]	5.412	5.521	5.275	5.403
New Stack				
Gas Conditions[2]				
Temperature (°F)	128	128	130	129
Moisture (volume %)[4]	14.7	14.7	14.4	14.6
O_2 (dry volume %)	6.8	6.8	6.6	6.7
CO_2 (dry volume %)	12.2	12.2	12.4	12.3
Volumetric Flow Rate[2]				
acfm	1,182,000	1,182,000	1,025,000	1,130,000
dscfm	883,300	883,300	765,100	843,900
Sulfur Dioxide				
ppm	87	104	130	107
lb/hr	768	918	992	890
lb/MBtu[3]	0.210	0.251	0.309	0.257
Sulfur Dioxide Removal Efficiency				
percent, based on lb/MBtu	96.1	95.5	94.1	95.2

[1] Runs 1-12 were issued in previous reports.
[2] The gas conditions and volumetric flow rates for Runs 13 and 14 were obtained from Particulate Run 14. The gas conditions and volumetric flow rates for Run 15 were obtained from Particulate Run 15. See Comments on page 4-1.
[3] As calculated with an Fd factor of 9,780.
[4] The gas flow for Runs 13 and 14 (Particulate Run 14) at the New Stack was saturated with moisture. The saturation moisture value is used in all calculations. See Comments on page 4-1.

TABLE 3 - Summary of Test Results

EPA Method 7E
Nitrogen Oxides
Units 7 and 8 Combined FGD Inlet and New Stack

Run No.[1]	13	14	15	AVERAGE
Date (1992)	September 16	September 16	September 16	
Start Time (approx.)	2:15 PM	3:42 PM	5:55 PM	
Stop Time (approx.)	3:15 PM	4:42 PM	6:55 PM	
Unit 8 Process Conditions				
Power Output (MW)	345	345	345	
Units 7 and 8 Combined FGD Inlet				
Gas Conditions[2]				
Temperature (°F)	331	331	331	331
Moisture (volume %)	8.4	8.4	6.6	7.8
O_2 (dry volume %)	6.6	6.6	6.2	6.5
CO_2 (dry volume %)	12.4	12.4	12.6	12.5
Volumetric Flow Rate[2]				
acfm	1,304,000	1,304,000	1,324,000	1,311,000
dscfm	792,700	792,700	820,800	802,100
Nitrogen Oxides				
ppm	992	1,091	1,126	1,070
lb/hr	5,635	6,200	6,620	6,152
lb/MBtu[3]	1.69	1.86	1.87	1.81
New Stack				
Gas Conditions[2]				
Temperature (°F)	128	128	130	129
Moisture (volume %)[4]	14.7	14.7	14.4	14.6
O_2 (dry volume %)	6.8	6.8	6.6	6.7
CO_2 (dry volume %)	12.2	12.2	12.4	12.3
Volumetric Flow Rate[2]				
acfm	1,182,000	1,182,000	1,025,000	1,130,000
dscfm	883,300	883,300	765,100	843,900
Nitrogen Oxides				
ppm	927	999	1,108	1,011
lb/hr	5,870	6,320	6,074	6,088
lb/MBtu[3]	1.61	1.73	1.89	1.74

[1] *Runs 1-12 were issued in previous reports.*
[2] The gas conditions and volumetric flow rates for Runs 13 and 14 were obtained from Particulate Run 14. The gas conditions and volumetric flow rates for Run 15 were obtained from Particulate Run 15. See Comments on page 4-1.
[3] *As calculated with an Fd factor of 9,780.*
[4] The gas flows for Runs 13 and 14 (Particulate Run 14) at the New Stack were saturated. The saturation moisture value is used in all calculations. See Comments on page 4-1.

TABLE 4 - Summary of Test Results

EPA Method 8
Sulfur Dioxide
Units 7 and 8 Combined FGD Inlet and New Stack

Run No.[1]	11	12	AVERAGE
Date (1992)	September 17	September 17	
Start Time (approx.)	9:55 AM	1:29 PM	
Stop Time (approx.)	11:11 AM	2:29 PM	
Unit 8 Process Conditions			
Power Output (MW)	345	345	
Units 7 and 8 Combined FGD Inlet			
Gas Conditions			
Temperature (°F)	332	332	332
Moisture (volume %)[2]	7.7	7.7	7.7
O_2 (dry volume %)[2]	7.0	7.0	7.0
CO_2 (dry volume %)[2]	12.0	12.0	12.0
Volumetric Flow Rate[3]			
acfm	1,220,000	1,220,000	1,220,000
dscfm	885,500	885,500	885,500
Sulfur Dioxide			
lb/dscf	3.85E-04	3.81E-04	3.83E-04
ppmdv	2,314	2,289	2,302
lb/hr	20,440	20,220	20,330
lb/MBtu[4]	5.66	5.60	5.63
New Stack			
Gas Conditions			
Temperature (°F)	129	130	130
Moisture (volume %)[2]	16.2	16.2	16.2
O_2 (dry volume %)[2]	7.2	7.2	7.2
CO_2 (dry volume %)[2]	12.0	12.0	12.0
Volumetric Flow Rate[2]			
acfm	1,238,000	1,238,000	1,238,000
dscfm	898,400	898,400	898,400
Sulfur Dioxide			
lb/dscf	3.35E-05	2.88E-05	3.12E-05
ppmdv	202	173	188
lb/hr	1,808	1,554	1,681
lb/MBtu[4]	0.500	0.430	0.465
Sulfur Dioxide Removal Efficiency			
percent, based on lb/MBtu	91.2	92.3	91.7

[1] Runs 1-10 were issued in previous reports.
[2] Moisture, O_2, CO_2, and volumetric flow rate values for Runs 11 and 12 were obtained from simultaneous Particulate Run 16A. See Comments on page 4-1.
[3] The adjusted volumetric flow rate values from Table 1, Run 16A were used.
[4] As calculated with an Fd factor of 9,780.

TABLE 5 - Summary of Test Results

EPA Method 8
Sulfuric Acid Mist (including Sulfur Trioxide)
Units 7 and 8 Combined FGD Inlet and New Stack

Run No.[1]	11	12	AVERAGE
Date (1992)	September 17	September 17	
Start Time (approx.)	9:55 AM	1:29 PM	
Stop Time (approx.)	11:11 AM	2:29 PM	
Unit 8 Process Conditions			
Power Output (MW)	345	345	
Units 7 and 8 Combined FGD Inlet			
Gas Conditions			
Temperature (°F)	332	332	332
Moisture (volume %)[2]	7.7	7.7	7.7
O_2 (dry volume %)[2]	7.0	7.0	7.0
CO_2 (dry volume %)[2]	12.0	12.0	12.0
Volumetric Flow Rate[3]			
acfm	1,220,000	1,220,000	1,220,000
dscfm	885,500	885,500	885,500
Sulfur Trioxide			
lb/dscf	6.25E-06	5.07E-06	5.66E-06
ppmdv	25	20	23
lb/hr	332	269	301
lb/MBtu[4]	0.0918	0.0745	0.0832
New Stack			
Gas Conditions			
Temperature (°F)	129	130	130
Moisture (volume %)[2]	16.2	16.2	16.2
O_2 (dry volume %)[2]	7.2	7.2	7.2
CO_2 (dry volume %)[2]	12.0	12.0	12.0
Volumetric Flow Rate[2]			
acfm	1,238,000	1,238,000	1,238,000
dscfm	898,400	898,400	898,400
Sulfur Trioxide			
lb/dscf	4.60E-06	4.69E-06	4.65E-06
ppmdv	18	18	18
lb/hr	248	253	251
lb/MBtu[4]	0.0686	0.0700	0.0693

[1] Runs 1-10 were issued in previous reports.
[2] Moisture, O_2, CO_2, and volumetric flow rate values for Runs 11 and 12 were obtained *from simultaneous* Particulate Run 16A. See Comments on page 4-1.
[3] The adjusted volumetric flow rate values from Table 1, Run 16A were used.
[4] As calculated with an Fd factor of 9,780.

TABLE 6 - Summary of Test Results

EPA Method 26
Hydrogen Chloride
Units 7 and 8 Combined FGD Inlet and New Stack

Run No.[1]	15	16A	AVERAGE
Date (1992)	September 16	September 17	
Start Time (approx.)	6:30 PM	12:50 PM	
Stop Time (approx.)	8:37 PM	3:17 PM	
Unit 8 Process Conditions			
Power Output (MW)	345	345	
Units 7 and 8 Combined FGD Inlet			
Gas Conditions			
Temperature (°F)	331	331	331
Moisture (volume %)	6.6	7.7	7.2
O_2 (dry volume %)	6.2	7.0	6.6
CO_2 (dry volume %)	12.6	12.0	12.3
Volumetric Flow Rate			
acfm	1,324,000	1,220,000[2]	1,272,000
dscfm	820,800	885,500[2]	853,200
Hydrogen Chloride			
lb/dscf	3.50E-06	5.65E-06	4.62E-06
ppmdv	37	60	49
lb/hr	172	300	236
lb/MBtu[3]	0.0486	0.0831	0.0659
New Stack			
Gas Conditions			
Temperature (°F)	130	133	132
Moisture (volume %)	14.4	16.2	15.3
O_2 (dry volume %)	6.6	7.2	6.9
CO_2 (dry volume %)	12.4	12.0	12.2
Volumetric Flow Rate			
acfm	1,025,000	1,238,000	1,132,000
dscfm	765,100	898,400	831,800
Hydrogen Chloride			
lb/dscf	2.07E-08	6.43E-08	4.44E-08
ppmdv	0.2	0.7	0.5
lb/hr	0.95	3.48	2.22
lb/MBtu[3]	2.95E-04	9.62E-04	6.29E-04
Hydrogen Chloride Removal Efficiency			
percent, based on lb/MBtu	99.4	98.8	99.1

1 *Runs 1-14 were issued in previous reports.*
2 The adjusted volumetric flow rate values from Table 1, Run 16A were used.
3 As calculated with an Fd factor of 9,780.

TABLE 7 - Summary of Test Results

EPA Method 26
Hydrogen Fluoride
Units 7 and 8 Combined FGD Inlet and New Stack

Run No. [1]	15	16A	AVERAGE
Date (1992)	September 16	September 17	
Start Time (approx.)	6:30 PM	12:50 PM	
Stop Time (approx.)	8:37 PM	3:17 PM	
Unit 8 Process Conditions			
Power Output (MW)	345	345	
Units 7 and 8 Combined FGD Inlet			
Gas Conditions			
Temperature (°F)	331	331	331
Moisture (volume %)	6.6	7.7	7.2
O_2 (dry volume %)	6.2	7.0	6.6
CO_2 (dry volume %)	12.6	12.0	12.3
Volumetric Flow Rate			
acfm	1,324,000	1,220,000 [2]	1,272,000
dscfm	820,800	885,500 [2]	853,200
Hydrogen Fluoride			
lb/dscf	3.45E-07	6.45E-07	5.01E-07
ppmdv	7	12	10
lb/hr	17.0	34.3	25.7
lb/MBtu [3]	0.00480	0.00949	0.00715
New Stack			
Gas Conditions			
Temperature (°F)	130	133	132
Moisture (volume %)	14.4	16.2	15.3
O_2 (dry volume %)	6.6	7.2	6.9
CO_2 (dry volume %)	12.4	12.0	12.2
Volumetric Flow Rate			
acfm	1,025,000	1,238,000	1,132,000
dscfm	765,100	898,400	831,800
Hydrogen Fluoride			
lb/dscf	<1.96E-09	<1.69E-09	<1.81E-09
ppmdv [4]	<1	<1	<1
lb/hr	<0.0901	<0.0909	<0.0905
lb/MBtu [3]	<2.81E-05	<2.52E-05	<2.67E-05
Hydrogen Fluoride Removal Efficiency			
percent, based on lb/MBtu	99.4	99.7	99.6

[1] Runs 1-14 were issued in previous reports.
[2] The adjusted volumetric flow rate values from Table 1, Run 16A were used.
[3] As calculated with an Fd factor of 9,780.
[4] < indicates measurements below the detectable limit of 1 ppm.

SECTION 6.5 MATERIAL BALANCE

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 11-Aug.92
DOE Test No. 1

GAS STREAMS

STREAM NO. DESCRIPTION	[A] AFGD Inlet	[B] AFGD Outlet	[C] Oxidation Air
Flue Gas Flow Rate:			
Volume (acfmw)	2,112,000	1,788,000	10,854
Volume (scfmd)	1,278,700	1,337,300	14,997
Mass (lbs/hr)	6,033,916	6,300,024	75,016
Flue Gas Condition:			
Temperature (F)	333	128	200
Pressure (iwc)	7.1	1.2	11.0 psig
Moisture(% v)	8.7	14.6	-
Oxygen (% d)	6.2	6.6	21.0
Carbon Dioxide (% d)	12.8	12.4	0.03
SO2 Flow Rate:			
Volume (ppmd)	2176	166	0
Mass (lbs/MMBtu)	5.03	0.40	0
HCl Flow Rate:			
Volume (ppmd)	-	-	0
Mass (lbs/MMBtu)	-	-	0
Particulate Flow Rate:			
Mass (lbs/MMBtu)	0.084	0.015	0
Volume (gr/dscf)	0.043	0.007	0

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 12-Aug.92
DOE Test No. 1A

GAS STREAMS

STREAM NO. DESCRIPTION	[A] AFGD Inlet	[B] AFGD Outlet	[C] Oxidation Air
Flue Gas Flow Rate:			
Volume (acfmw)	2,016,700	1,714,300	10,857
Volume (scfmd)	1,253,300	1,294,700	15,002
Mass (lbs/hr)	5,908,200	6,095,300	75,041
Flue Gas Condition:			
Temperature (F)	322	127	200
Pressure (iwc)	5.8	1.2	11.0 psig
Moisture(% v)	7.6	14.2	-
Oxygen (% d)	6.2	6.7	21.0
Carbon Dioxide (% d)	12.7	12.3	0.03
SO2 Flow Rate:			
Volume (ppmd)	2241	158	0
Mass (lbs/MMBtu)	5.16	0.38	0
HCl Flow Rate:			
Volume (ppmd)	37	2	0
Mass (lbs/MMBtu)	0.049	0.002	0
Particulate Flow Rate:			
Mass (lbs/MMBtu)	0.064	0.016	0
Volume (gr/dscf)	0.032	0.008	0

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 13-Aug.92
DOE Test No. 2

GAS STREAMS

STREAM NO. DESCRIPTION	[A] AFGD Inlet	[B] AFGD Outlet	[C] Oxidation Air
Flue Gas Flow Rate:			
Volume (acfmw)	2,130,000	1,796,300	10,856
Volume (scfmd)	1,322,000	1,356,300	15,001
Volume (lbs/hr)	6,227,946	6,391,645	75,036
Flue Gas Condition:			
Temperature (F)	326	127	200
Pressure (iwc)	6.9	1.2	11.0 psig
Moisture(% v)	7.5	14.3	-
Oxygen (% d)	6.3	6.4	21.0
Carbon Dioxide (% d)	12.6	12.6	0.03
SO2 Flow Rate:			
Volume (ppmd)	2280	158	0
Mass (lbs/MMBtu)	5.27	0.37	0
HCl Flow Rate:			
Volume (ppmd)	-	-	0
Mass (lbs/MMBtu)	-	-	0
Particulate Flow Rate:			
Mass (lbs/MMBtu)	0.045	0.013	0
Volume (gr/dscf)	0.022	0.007	0

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 26-Aug.92
DOE Test No. 27

GAS STREAMS

STREAM NO. DESCRIPTION	[A] AFGD Inlet	[B] AFGD Outlet	[C] Oxidation Air
Flue Gas Flow Rate:			
Volume (acfmw)	788,700	602,900	1,977
Volume (scfmd)	501,000	455,300	2,603
Volume (lbs/hr)	2,352,410	2,136,410	13,020
Flue Gas Condition:			
Temperature (F)	295	129	200
Pressure (iwc)	0.8	-0.4	9.8 psig
Moisture(% v)	7.4	13.6	-
Oxygen (% d)	7.6	7.9	21.0
Carbon Dioxide (% d)	11.5	11.3	0.03
SO2 Flow Rate:			
Volume (ppmd)	2099	14	0
Mass (lbs/MMBtu)	5.29	0.04	0
HCl Flow Rate:			
Volume (ppmd)	71	0.4	0
Mass (lbs/MMBtu)	1.326	0.001	0
Particulate Flow Rate:			
Mass (lbs/MMBtu)	0.052	0.020	0
Volume (gr/dscf)	0.023	0.009	0

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date: 16-Sept.92
DOE Test No.: 19

GAS STREAMS

STREAM NO. DESCRIPTION	[A] AFGD Inlet	[B] AFGD Outlet	[C] Oxidation Air
Flue Gas Flow Rate:			
Volume (acfmw)	1,314,000	1,103,500	7,270
Volume (scfmd)	806,750	824,200	10,044
Volume (lbs/hr)	3,800,600	3,880,240	50,241
Flue Gas Condition:			
Temperature (F)	331	129	200
Pressure (iwc)	3.0	0.1	11.0 psig
Moisture(% v)	7.5	14.6	-
Oxygen (% d)	6.4	6.7	21.0
Carbon Dioxide (% d)	12.5	12.3	0.03
SO2 Flow Rate:			
Volume (ppmd)	2294	107	0
Mass (lbs/MMBtu)	5.40	0.26	0
HCl Flow Rate:			
Volume (ppmd)	37	0.4	0
Mass (lbs/MMBtu)	0.049	0.0003	0
Particulate Flow Rate:			
Mass (lbs/MMBtu)	0.074	0.020	0
Volume (gr/dscf)	0.036	0.010	0

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 17-Sept.92
DOE Test No. 20

GAS STREAMS

STREAM NO. DESCRIPTION	[A] AFGD Inlet	[B] AFGD Outlet	[C] Oxidation Air
Flue Gas Flow Rate:			
Volume (acfmw)	1,220,000	1,238,000	3,760
Volume (scfmd)	885,500	898,400	4,885
Volume (lbs/hr)	4,164,700	4,225,370	24,435
Flue Gas Condition:			
Temperature (F)	331	133	200
Pressure (iwc)	3.0	0.1	9.5 psig
Moisture(% v)	7.7	16.2	-
Oxygen (% d)	7.0	7.2	21.0
Carbon Dioxide (% d)	12.0	12.0	0.03
SO2 Flow Rate:			
Volume (ppmd)	2302	188	0
Mass (lbs/MMBtu)	5.63	0.47	0
HCl Flow Rate:			
Volume (ppmd)	60	0.7	0
Mass (lbs/MMBtu)	0.083	0.001	0
Particulate Flow Rate:			
Mass (lbs/MMBtu)	0.076	0.012	0
Volume (gr/dscf)	0.036	0.006	0

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 11-Aug. 92
DOE Test No. 1

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	19.17	19.17	18.46	9.09	2.25	0.116
DENSITY (SGU)	1.136	1.136	1.13	na	1.023	1.015
FLOW RATE						
CaCO3 (lbs/hr)	317,487	1,347	1,857	1,305	552	42
CaSO4.2H2O (lbs/hr)	17,204,276	72,983	79,963	72,816	7,147	167
Inerts (lbs/hr)	306,172	1,299	2,496	1,112	1,384	187
Solids (lbs/hr)	17,827,935	75,628	84,315	75,232	9,083	396
Water (lbs/hr)	75,171,205	318,885	372,368	7,522	394,609	341,126
Total Slurry (lbs/hr)	92,999,140	394,513	456,683	82,754	403,692	341,522
Total Slurry (tph)	46,500	197	228	41	202	171
Total Slurry (gpm)	163,600	694	808	na	789	672

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 11-Aug. 92
DOE Test No. 1

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.116	0.116	14.6	100
DENSITY (SGU)	1.015	1.015	1.101	na
FLOW RATE				
$CaCO_3$ (lbs/hr)	7	35	510	42,428
$CaSO_4.2H_2O$ (lbs/hr)	27	140	6,980	0
Inerts (lbs/hr)	30	157	1,197	999
Solids (lbs/hr)	64	332	8,687	43,427
Water (lbs/hr)	55,450	285,676	53,483	na
Total Slurry (lbs/hr)	55,514	286,008	62,170	na
Total Slurry (lph)	28	143	31	22
Total Slurry (gpm)	109	563	116	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 12-Aug. 92
DOE Test No. 1A

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	21.2	21.2	20.56	6.59	2.78	0.06
DENSITY (SGU)	1.148	1.148	1.13	na	1.026	1.0145
FLOW RATE						
CaCO3 (lbs/hr)	361,816	1,351	1,834	1,337	497	15
CaSO4.2H2O (lbs/hr)	19,218,922	71,783	79,712	71,615	8,097	169
Inerts (lbs/hr)	343,345	1,282	3,624	1,267	2,357	15
Solids (lbs/hr)	19,924,083	74,417	85,170	74,218	10,952	198
Water (lbs/hr)	74,057,442	276,606	329,000	5,236	382,988	330,595
Total Slurry (lbs/hr)	93,981,525	351,023	414,170	79,454	393,940	330,793
Total Slurry (tph)	46,991	176	207	40	197	165
Total Slurry (gpm)	163,600	611	732	na	767	652

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 12-Aug. 92
DOE Test No. 1A

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	18.1	100
DENSITY (SGU)	1.0145	1.0145	1.12	na
FLOW RATE				
CaCO3 (lbs/hr)	2	12	483	41,731
CaSO4.2H2O (lbs/hr)	28	141	7,929	0
Inerts (lbs/hr)	2	13	2,342	982
Solids (lbs/hr)	33	166	10,753	42,713
Water (lbs/hr)	54,236	276,359	52,393	na
Total Slurry (lbs/hr)	54,268	276,525	63,146	na
Total Slurry (tph)	27	138	32	21
Total Slurry (gpm)	107	545	116	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 13-Aug. 92
DOE Test No. 2

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	21.5	21.5	19.53	7.32	2.57	0.06
DENSITY (SGU)	1.159	1.159	1.13	na	1.024	1.015
FLOW RATE						
CaCO3 (lbs/hr)	432,321	1,734	2,478	1,721	757	13
CaSO4.2H2O (lbs/hr)	19,623,940	78,694	89,297	78,490	10,808	204
Inerts (lbs/hr)	343,379	1,377	2,961	1,348	1,612	29
Solids (lbs/hr)	20,399,640	81,804	94,736	81,559	13,177	245
Water (lbs/hr)	74,482,405	298,680	390,381	6,442	499,540	407,840
Total Slurry (lbs/hr)	94,882,045	380,484	485,117	88,001	512,717	408,084
Total Slurry (tph)	47,441	190	243	44	256	204
Total Slurry (gpm)	163,600	656	858	na	1,001	803

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 13-Aug. 92
DOE Test No. 2

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	12.8	100
DENSITY (SGU)	1.015	1.015	1.087	na
FLOW RATE				
CaCO3 (lbs/hr)	2	11	744	45,748
CaSO4.2H2O (lbs/hr)	29	175	10,604	0
Inerts (lbs/hr)	4	24	1,584	1,077
Solids (lbs/hr)	35	210	12,932	46,825
Water (lbs/hr)	58,019	349,821	91,701	na
Total Slurry (lbs/hr)	58,054	350,031	104,633	na
Total Slurry (tph)	29	175	52	23
Total Slurry (gpm)	114	689	197	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 17-Aug. 92
DOE Test No. 6

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	24.5	24.5	22.17	6.14	2.41	0.06
DENSITY (SGU)	1.184	1.184	1.13	na	1.024	1.011
FLOW RATE						
CaCO3 (lbs/hr)	549,612	1,987	2,774	1,961	813	27
CaSO4.2H2O (lbs/hr)	23,991,406	86,752	99,982	86,511	13,471	241
Inerts (lbs/hr)	411,304	1,487	2,298	1,442	857	46
Solids (lbs/hr)	24,952,322	90,226	105,054	89,913	15,141	314
Water (lbs/hr)	76,893,890	278,045	368,762	5,882	613,124	522,407
Total Slurry (lbs/hr)	101,846,212	368,271	473,816	95,795	628,265	522,720
Total Slurry (tph)	50,923	184	237	48	314	261
Total Slurry (gpm)	171,900	622	838	na	1,226	1,033

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 17-Aug. 92
DOE Test No. 6

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	15	100
DENSITY (SGU)	1.011	1.011	1.099	na
FLOW RATE				
CaCO3 (lbs/hr)	3	24	786	50,433
CaSO4.2H2O (lbs/hr)	26	215	13,230	0
Inerts (lbs/hr)	5	41	811	1,187
Solids (lbs/hr)	33	280	14,828	51,620
Water (lbs/hr)	55,616	466,791	90,717	na
Total Slurry (lbs/hr)	55,649	467,071	105,545	na
Total Slurry (tph)	28	234	53	26
Total Slurry (gpm)	110	923	193	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 18-Aug. 92
DOE Test No. 3

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	132	132	132	Amb	132	na
SOLIDS CONTENT (%)	25.3	25.3	23.78	7.34	1.29	0.06
DENSITY (SGU)	1.184	1.184	1.13	na	1.02	1.0125
FLOW RATE						
CaCO3 (lbs/hr)	271,678	834	1,171	831	340	4
CaSO4.2H2O (lbs/hr)	25,054,835	76,945	79,852	76,831	3,022	114
Inerts (lbs/hr)	440,579	1,353	1,470	1,328	141	25
Solids (lbs/hr)	25,767,092	79,132	82,493	78,990	3,503	142
Water (lbs/hr)	76,079,120	233,644	264,343	6,257	268,034	237,335
Total Slurry (lbs/hr)	101,846,212	312,776	346,836	85,247	271,537	237,477
Total Slurry (tph)	50,923	156	173	43	136	119
Total Slurry (gpm)	171,900	528	613	na	532	469

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 18-Aug. 92
DOE Test No. 3

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	10.4	100
DENSITY (SGU)	1.0125	1.0125	1.069	na
FLOW RATE				
CaCO3 (lbs/hr)	1	3	336	44,732
CaSO4.2H2O (lbs/hr)	27	87	2,907	0
Inerts (lbs/hr)	6	19	117	1,053
Solids (lbs/hr)	34	109	3,360	45,785
Water (lbs/hr)	56,002	181,332	30,700	na
Total Slurry (lbs/hr)	56,036	181,441	34,060	na
Total Slurry (tph)	28	91	17	23
Total Slurry (gpm)	111	358	63	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 22-Aug. 92
DOE Test No. 23

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	130	130	130	Amb	130	na
SOLIDS CONTENT (%)	24.37	24.37	18.71	6.62	2.38	0.06
DENSITY (SGU)	1.173	1.173	1.13	na	1.021	1.012
FLOW RATE						
CaCO3 (lbs/hr)	318,241	458	665	456	209	1
CaSO4.2H2O (lbs/hr)	19,969,890	28,718	31,353	28,677	2,676	41
Inerts (lbs/hr)	481,915	693	1,290	680	610	13
Solids (lbs/hr)	20,770,046	29,869	33,309	29,814	3,495	55
Water (lbs/hr)	64,457,882	92,695	144,747	2,114	143,340	91,288
Total Slurry (lbs/hr)	85,227,928	122,564	178,056	31,928	146,835	91,343
Total Slurry (tph)	42,614	61	89	16	73	46
Total Slurry (gpm)	145,200	209	315	na	287	180

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 22-Aug. 92
DOE Test No. 23

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	6.29	100
DENSITY (SGU)	1.012	1.012	1.042	na
FLOW RATE				
CaCO3 (lbs/hr)	1	1	208	16,695
CaSO4.2H2O (lbs/hr)	25	16	2,635	0
Inerts (lbs/hr)	8	5	597	393
Solids (lbs/hr)	33	22	3,440	17,088
Water (lbs/hr)	55,165	36,123	52,053	na
Total Slurry (lbs/hr)	55,198	36,144	55,492	na
Total Slurry (tph)	28	18	28	9
Total Slurry (gpm)	109	71	107	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 23-Aug. 92
DOE Test No. 24

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	130	130	130	Amb	130	na
SOLIDS CONTENT (%)	24.97	24.97	21.44	4.54	1.7	0.06
DENSITY (SGU)	1.172	1.172	1.13	na	1.016	1.01
FLOW RATE						
CaCO3 (lbs/hr)	193,473	265	394	262	132	3
CaSO4.2H2O (lbs/hr)	20,569,097	28,151	29,865	28,096	1,769	55
Inerts (lbs/hr)	500,701	685	1,561	664	898	22
Solids (lbs/hr)	21,263,271	29,101	31,820	29,022	2,799	80
Water (lbs/hr)	63,891,999	87,444	116,582	1,380	161,823	132,686
Total Slurry (lbs/hr)	85,155,270	116,545	148,402	30,402	164,622	132,765
Total Slurry (tph)	42,578	58	74	15	82	66
Total Slurry (gpm)	145,200	199	262	na	324	263

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 23-Aug. 92
DOE Test No. 24

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	8.75	100
DENSITY (SGU)	1.01	1.01	1.058	na
FLOW RATE				
CaCO3 (lbs/hr)	1	2	129	16,366
CaSO4.2H2O (lbs/hr)	23	32	1,714	0
Inerts (lbs/hr)	9	13	876	385
Solids (lbs/hr)	33	47	2,719	16,751
Water (lbs/hr)	54,551	78,135	29,138	na
Total Slurry (lbs/hr)	54,584	78,182	31,857	na
Total Slurry (tph)	27	39	16	8
Total Slurry (gpm)	108	155	61	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 24-Aug. 92
DOE Test No. 25

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	132	132	132	Amb	132	na
SOLIDS CONTENT (%)	25.27	25.27	17.38	6.73	2	0.06
DENSITY (SGU)	1.176	1.176	1.13	na	1.02	1.01
FLOW RATE						
CaCO3 (lbs/hr)	167,155	274	386	269	117	5
CaSO4.2H2O (lbs/hr)	18,476,199	30,318	33,008	30,282	2,725	35
Inerts (lbs/hr)	435,686	715	1,097	703	394	12
Solids (lbs/hr)	19,079,040	31,307	34,490	31,254	3,236	52
Water (lbs/hr)	56,421,712	92,582	163,946	2,255	158,563	87,200
Total Slurry (lbs/hr)	75,500,752	123,889	198,436	33,510	161,799	87,252
Total Slurry (tph)	37,750	62	99	17	81	44
Total Slurry (gpm)	128,300	211	351	na	317	173

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 24-Aug. 92
DOE Test No. 25

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	4.32	100
DENSITY (SGU)	1.01	1.01	1.026	na
FLOW RATE				
CaCO3 (lbs/hr)	3	2	112	17,625
CaSO4.2H2O (lbs/hr)	21	14	2,690	0
Inerts (lbs/hr)	7	5	382	415
Solids (lbs/hr)	31	21	3,184	18,040
Water (lbs/hr)	51,874	35,326	71,364	na
Total Slurry (lbs/hr)	51,905	35,347	74,547	na
Total Slurry (tph)	26	18	37	9
Total Slurry (gpm)	103	70	144	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 25-Aug. 92
DOE Test No. 26

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	132	132	132	Amb	132	na
SOLIDS CONTENT (%)	25.53	25.53	22.14	5.8	1.99	0.06
DENSITY (SGU)	1.179	1.179	1.13	na	1.019	1.01
FLOW RATE						
CaCO3 (lbs/hr)	164,925	269	322	268	54	1
CaSO4.2H2O (lbs/hr)	18,719,432	30,526	32,253	30,488	1,765	37
Inerts (lbs/hr)	440,157	718	1,248	703	545	15
Solids (lbs/hr)	19,324,514	31,513	33,823	31,459	2,364	54
Water (lbs/hr)	56,368,842	91,921	118,928	1,937	116,444	89,437
Total Slurry (lbs/hr)	75,693,356	123,434	152,751	33,396	118,808	89,491
Total Slurry (tph)	37,847	62	76	17	59	45
Total Slurry (gpm)	128,300	209	270	na	233	177

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 25-Aug. 92
DOE Test No. 26

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	8.1	100
DENSITY (SGU)	1.01	1.01	1.049	na
FLOW RATE				
CaCO3 (lbs/hr)	1	0	53	17,746
CaSO4.2H2O (lbs/hr)	23	15	1,727	0
Inerts (lbs/hr)	9	6	530	418
Solids (lbs/hr)	33	21	2,311	18,164
Water (lbs/hr)	54,197	35,240	27,007	na
Total Slurry (lbs/hr)	54,230	35,261	29,317	na
Total Slurry (tph)	27	18	15	9
Total Slurry (gpm)	107	70	56	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 26-Aug. 92
DOE Test No. 27

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	132	132	132	Amb	132	na
SOLIDS CONTENT (%)	25	25	22.18	4.87	1.3	0.06
DENSITY (SGU)	1.176	1.176	1.13	na	1.015	1.01
FLOW RATE						
CaCO3 (lbs/hr)	170,844	274	316	272	44	2
CaSO4.2H2O (lbs/hr)	18,267,275	29,295	31,592	29,223	2,369	72
Inerts (lbs/hr)	437,069	701	983	665	317	36
Solids (lbs/hr)	18,875,188	30,270	32,890	30,160	2,730	110
Water (lbs/hr)	56,625,564	90,810	115,420	1,544	207,239	182,628
Total Slurry (lbs/hr)	75,500,752	121,080	148,310	31,704	209,968	182,738
Total Slurry (tph)	37,750	61	74	16	105	91
Total Slurry (gpm)	128,300	206	262	na	413	362

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 26-Aug. 92
DOE Test No. 27

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	9.95	100
DENSITY (SGU)	1.01	1.01	1.064	na
FLOW RATE				
CaCO3 (lbs/hr)	1	1	42	17,030
CaSO4.2H2O (lbs/hr)	21	51	2,297	0
Inerts (lbs/hr)	10	26	282	401
Solids (lbs/hr)	31	78	2,620	17,431
Water (lbs/hr)	52,177	130,451	24,610	na
Total Slurry (lbs/hr)	52,208	130,530	27,230	na
Total Slurry (tph)	26	65	14	9
Total Slurry (gpm)	103	258	52	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 27-Aug. 92
DOE Test No. 4

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	25.8	25.8	23.50	4.95	2.58	0.06
DENSITY (SGU)	1.179	1.179	1.13	na	1.023	1.01
FLOW RATE						
CaCO3 (lbs/hr)	858,320	2,870	4,146	2,851	1,295	19
CaSO4.2H2O (lbs/hr)	24,876,870	83,189	91,710	83,025	8,685	164
Inerts (lbs/hr)	430,169	1,438	3,930	1,382	2,548	57
Solids (lbs/hr)	26,165,358	87,498	99,786	87,258	12,528	240
Water (lbs/hr)	75,250,760	251,641	324,799	4,544	473,069	399,911
Total Slurry (lbs/hr)	101,416,118	339,139	424,585	91,802	485,597	400,151
Total Slurry (tph)	50,708	170	212	46	243	200
Total Slurry (gpm)	171,900	575	751	na	949	792

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 27-Aug. 92
DOE Test No. 4

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	15.3	100
DENSITY (SGU)	1.01	1.01	1.1	na
FLOW RATE				
CaCO3 (lbs/hr)	3	17	1,276	48,361
CaSO4.2H2O (lbs/hr)	23	141	8,521	0
Inerts (lbs/hr)	8	49	2,491	1,138
Solids (lbs/hr)	34	206	12,288	49,500
Water (lbs/hr)	56,622	343,289	73,158	na
Total Slurry (lbs/hr)	56,656	343,495	85,446	na
Total Slurry (tph)	28	172	43	25
Total Slurry (gpm)	112	680	157	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 28-Aug. 92
DOE Test No. 5

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	130	130	130	Amb	130	na
SOLIDS CONTENT (%)	24.9	24.9	25.06	7.34	3.06	0.06
DENSITY (SGU)	1.176	1.176	1.13	na	1.026	1.01
FLOW RATE						
CaCO3 (lbs/hr)	958,228	3,364	4,957	3,338	1,618	26
CaSO4.2H2O (lbs/hr)	23,818,708	83,626	92,906	83,468	9,438	158
Inerts (lbs/hr)	411,422	1,444	3,192	1,406	1,786	39
Solids (lbs/hr)	25,188,357	88,435	101,054	88,212	12,842	223
Water (lbs/hr)	75,969,704	266,726	302,185	6,988	406,820	371,361
Total Slurry (lbs/hr)	101,158,062	355,161	403,239	95,200	419,662	371,584
Total Slurry (tph)	50,579	178	202	48	210	186
Total Slurry (gpm)	171,900	604	713	na	817	735

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 28-Aug. 92
DOE Test No. 5

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	29.9	100
DENSITY (SGU)	1.01	1.01	1.212	na
FLOW RATE				
CaCO3 (lbs/hr)	4	22	1,592	48,616
CaSO4.2H2O (lbs/hr)	22	137	9,279	0
Inerts (lbs/hr)	5	34	1,747	1,144
Solids (lbs/hr)	30	193	12,619	49,760
Water (lbs/hr)	50,510	320,851	35,459	na
Total Slurry (lbs/hr)	50,540	321,044	48,078	na
Total Slurry (tph)	25	161	24	25
Total Slurry (gpm)	100	635	82	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 01-Sept. 92
DOE Test No. 7

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	130	130	130	Amb	130	na
SOLIDS CONTENT (%)	24.77	24.77	24.14	6.06	2.32	0.06
DENSITY (SGU)	1.177	1.177	1.13	na	1.024	1.0115
FLOW RATE						
CaCO3 (lbs/hr)	482,775	1,867	2,441	1,845	596	22
CaSO4.2H2O (lbs/hr)	20,444,899	79,047	84,889	78,928	5,961	119
Inerts (lbs/hr)	357,395	1,382	2,163	1,355	808	27
Solids (lbs/hr)	21,285,069	82,295	89,492	82,128	7,365	167
Water (lbs/hr)	64,645,771	249,942	281,290	5,298	310,073	278,726
Total Slurry (lbs/hr)	85,930,840	332,238	370,782	87,426	317,438	278,893
Total Slurry (tph)	42,965	166	185	44	159	139
Total Slurry (gpm)	145,900	564	656	na	620	551

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 01-Sept. 92
DOE Test No. 7

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	20.5	100
DENSITY (SGU)	1.0115	1.0115	1.135	na
FLOW RATE				
CaCO3 (lbs/hr)	4	18	575	45,953
CaSO4.2H2O (lbs/hr)	24	95	5,842	0
Inerts (lbs/hr)	5	21	781	1,082
Solids (lbs/hr)	33	134	7,197	47,035
Water (lbs/hr)	55,340	223,385	31,348	na
Total Slurry (lbs/hr)	55,373	223,520	38,545	na
Total Slurry (tph)	28	112	19	24
Total Slurry (gpm)	109	442	68	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 02-Sept. 92
DOE Test No. 8

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	24.43	24.43	23.03	6.2	2.5	0.06
DENSITY (SGU)	1.179	1.179	1.13	na	1.024	1.01
FLOW RATE						
CaCO3 (lbs/hr)	534,497	1,828	2,616	1,806	809	22
CaSO4.2H2O (lbs/hr)	21,879,713	74,821	82,752	74,686	8,067	136
Inerts (lbs/hr)	387,167	1,324	1,718	1,294	424	30
Solids (lbs/hr)	22,801,376	77,973	87,086	77,785	9,300	188
Water (lbs/hr)	70,532,131	241,197	290,974	5,141	362,709	312,932
Total Slurry (lbs/hr)	93,333,507	319,170	378,060	82,927	372,009	313,120
Total Slurry (tph)	46,667	160	189	41	186	157
Total Slurry (gpm)	158,200	541	669	na	726	620

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 02-Sept. 92
DOE Test No. 8

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	16.7	100
DENSITY (SGU)	1.01	1.01	1.119	na
FLOW RATE				
CaCO3 (lbs/hr)	4	18	788	43,497
CaSO4.2H2O (lbs/hr)	24	112	7,931	0
Inerts (lbs/hr)	5	25	394	1,024
Solids (lbs/hr)	33	155	9,112	44,521
Water (lbs/hr)	55,561	257,371	49,777	na
Total Slurry (lbs/hr)	55,594	257,525	58,890	na
Total Slurry (tph)	28	129	29	22
Total Slurry (gpm)	110	510	106	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 03-Sept. 92
DOE Test No. 9

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	26.17	26.17	22.40	8	2.52	0.06
DENSITY (SGU)	1.187	1.187	1.13	na	1.023	1.01
FLOW RATE						
CaCO3 (lbs/hr)	627,838	1,874	2,812	1,861	951	12
CaSO4.2H2O (lbs/hr)	27,167,188	81,080	89,814	80,937	8,877	143
Inerts (lbs/hr)	472,321	1,410	3,249	1,349	1,900	61
Solids (lbs/hr)	28,267,347	84,364	95,875	84,148	11,727	216
Water (lbs/hr)	79,746,971	238,004	332,078	7,317	453,649	359,575
Total Slurry (lbs/hr)	108,014,317	322,368	427,953	91,465	465,377	359,791
Total Slurry (tph)	54,007	161	214	46	233	180
Total Slurry (gpm)	181,850	543	757	na	909	712

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 03-Sept. 92
DOE Test No. 9

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	11.4	100
DENSITY (SGU)	1.01	1.01	1.074	na
FLOW RATE				
CaCO3 (lbs/hr)	2	11	939	47,135
CaSO4.2H2O (lbs/hr)	21	122	8,734	0
Inerts (lbs/hr)	9	52	1,839	1,110
Solids (lbs/hr)	31	185	11,512	48,245
Water (lbs/hr)	52,227	307,348	94,074	na
Total Slurry (lbs/hr)	52,259	307,532	105,586	na
Total Slurry (tph)	26	154	53	24
Total Slurry (gpm)	103	608	197	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 04-Sept. 92
DOE Test No. 7R

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	23.73	23.73	22.37	6.88	2.32	0.06
DENSITY (SGU)	1.169	1.169	1.13	na	1.022	1.01
FLOW RATE						
CaCO3 (lbs/hr)	504,088	2,039	2,758	2,021	737	18
CaSO4.2H2O (lbs/hr)	19,408,922	78,520	86,990	78,345	8,645	175
Inerts (lbs/hr)	339,780	1,375	3,067	1,322	1,745	53
Solids (lbs/hr)	20,252,789	81,933	92,814	81,688	11,127	246
Water (lbs/hr)	65,093,984	263,340	322,079	6,035	468,472	409,733
Total Slurry (lbs/hr)	85,346,773	345,274	414,894	87,723	479,599	409,979
Total Slurry (tph)	42,673	173	207	44	240	205
Total Slurry (gpm)	145,900	590	734	na	938	811

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 04-Sept. 92
DOE Test No. 7R

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	16.8	100
DENSITY (SGU)	1.01	1.01	1.111	na
FLOW RATE				
CaCO3 (lbs/hr)	2	16	719	45,647
CaSO4.2H2O (lbs/hr)	23	152	8,470	0
Inerts (lbs/hr)	7	46	1,692	1,075
Solids (lbs/hr)	32	214	10,881	46,721
Water (lbs/hr)	53,036	356,698	58,739	na
Total Slurry (lbs/hr)	53,067	356,912	69,620	na
Total Slurry (lph)	27	178	35	23
Total Slurry (gpm)	105	706	127	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 08-Sept. 92
DOE Test No. 14

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	130	130	130	Amb	130	na
SOLIDS CONTENT (%)	24	24	22.43	6.6	2.6	0.06
DENSITY (SGU)	1.168	1.168	1.13	na	1.024	1.012
FLOW RATE						
CaCO3 (lbs/hr)	516,759	1,355	1,939	1,349	590	6
CaSO4.2H2O (lbs/hr)	19,566,771	51,316	56,648	51,209	5,439	108
Inerts (lbs/hr)	382,173	1,002	2,522	970	1,552	32
Solids (lbs/hr)	20,465,703	53,674	61,109	53,528	7,581	146
Water (lbs/hr)	64,808,061	169,968	211,296	3,783	283,980	242,653
Total Slurry (lbs/hr)	85,273,764	223,642	272,405	57,311	291,561	242,798
Total Slurry (tph)	42,637	112	136	29	146	121
Total Slurry (gpm)	145,900	383	482	na	569	479

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 08-Sept. 92
DOE Test No. 14

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	16.2	100
DENSITY (SGU)	1.012	1.012	1.114	na
FLOW RATE				
CaCO3 (lbs/hr)	1	4	584	29,833
CaSO4.2H2O (lbs/hr)	26	82	5,331	0
Inerts (lbs/hr)	8	24	1,520	702
Solids (lbs/hr)	35	111	7,435	30,535
Water (lbs/hr)	58,151	184,502	41,328	na
Total Slurry (lbs/hr)	58,186	184,612	48,763	na
Total Slurry (tph)	29	92	24	15
Total Slurry (gpm)	115	365	90	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 09-Sept. 92
DOE Test No. 15A

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	132	132	132	Amb	132	na
SOLIDS CONTENT (%)	25.13	25.13	22.01	6.33	2.3	0.06
DENSITY (SGU)	1.184	1.184	1.13	na	1.022	1.012
FLOW RATE						
CaCO3 (lbs/hr)	197,572	452	789	447	342	5
CaSO4.2H2O (lbs/hr)	21,105,318	48,289	52,967	48,211	4,757	79
Inerts (lbs/hr)	419,959	961	1,297	933	364	27
Solids (lbs/hr)	21,722,849	49,702	55,054	49,591	5,462	111
Water (lbs/hr)	64,719,049	148,078	195,031	3,351	232,036	185,083
Total Slurry (lbs/hr)	86,441,898	197,781	250,085	52,942	237,498	185,194
Total Slurry (tph)	43,221	99	125	26	119	93
Total Slurry (gpm)	145,900	334	442	na	464	366

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 09-Sept. 92
DOE Test No. 15A

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	10.6	100
DENSITY (SGU)	1.012	1.012	1.068	na
FLOW RATE				
CaCO3 (lbs/hr)	1	4	337	28,073
CaSO4.2H2O (lbs/hr)	21	57	4,678	0
Inerts (lbs/hr)	8	20	336	661
Solids (lbs/hr)	30	81	5,351	28,734
Water (lbs/hr)	50,610	134,473	46,953	na
Total Slurry (lbs/hr)	50,640	134,554	52,304	na
Total Slurry (tph)	25	67	26	14
Total Slurry (gpm)	100	266	99	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 10-Sept. 92
DOE Test No. 16

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	130	130	130	Amb	130	na
SOLIDS CONTENT (%)	25.13	25.13	22.91	6.07	2.51	0.06
DENSITY (SGU)	1.179	1.179	1.13	na	1.024	1.012
FLOW RATE						
CaCO3 (lbs/hr)	344,739	828	1,134	824	310	4
CaSO4.2H2O (lbs/hr)	20,875,771	50,140	55,671	50,038	5,633	102
Inerts (lbs/hr)	410,604	986	1,900	957	942	29
Solids (lbs/hr)	21,631,114	51,954	58,705	51,819	6,886	135
Water (lbs/hr)	64,445,742	154,787	197,574	3,349	267,458	224,672
Total Slurry (lbs/hr)	86,076,856	206,741	256,279	55,168	274,344	224,807
Total Slurry (tph)	43,038	103	128	28	137	112
Total Slurry (gpm)	145,900	350	453	na	535	444

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 10-Sept. 92
DOE Test No. 16

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	14.4	100
DENSITY (SGU)	1.012	1.012	1.089	na
FLOW RATE				
CaCO3 (lbs/hr)	1	3	306	29,149
CaSO4.2H2O (lbs/hr)	23	79	5,531	0
Inerts (lbs/hr)	7	22	914	686
Solids (lbs/hr)	31	104	6,751	29,835
Water (lbs/hr)	50,964	173,707	42,786	na
Total Slurry (lbs/hr)	50,995	173,812	49,538	na
Total Slurry (tph)	25	87	25	15
Total Slurry (gpm)	101	343	91	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 10-Sept. 92
DOE Test No. 16

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	130	130	130	Amb	130	na
SOLIDS CONTENT (%)	25.13	25.13	22.91	6.07	2.51	0.06
DENSITY (SGU)	1.179	1.179	1.13	na	1.024	1.012
FLOW RATE						
CaCO3 (lbs/hr)	344,739	828	1,134	824	310	4
CaSO4.2H2O (lbs/hr)	20,875,771	50,140	55,671	50,038	5,633	102
Inerts (lbs/hr)	410,604	986	1,900	957	942	29
Solids (lbs/hr)	21,631,114	51,954	58,705	51,819	6,886	135
Water (lbs/hr)	64,445,742	154,787	197,574	3,349	267,458	224,672
Total Slurry (lbs/hr)	86,076,856	206,741	256,279	55,168	274,344	224,807
Total Slurry (tph)	43,038	103	128	28	137	112
Total Slurry (gpm)	145,900	350	453	na	535	444

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 10-Sept. 92
DOE Test No. 16

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	14.4	100
DENSITY (SGU)	1.012	1.012	1.089	na
FLOW RATE				
CaCO3 (lbs/hr)	1	3	306	29,149
CaSO4.2H2O (lbs/hr)	23	79	5,531	0
Inerts (lbs/hr)	7	22	914	686
Solids (lbs/hr)	31	104	6,751	29,835
Water (lbs/hr)	50,964	173,707	42,786	na
Total Slurry (lbs/hr)	50,995	173,812	49,538	na
Total Slurry (tph)	25	87	25	15
Total Slurry (gpm)	101	343	91	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 10-Sept. 92
DOE Test No. 16

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	130	130	130	Amb	130	na
SOLIDS CONTENT (%)	25.13	25.13	22.91	6.07	2.51	0.06
DENSITY (SGU)	1.179	1.179	1.13	na	1.024	1.012
FLOW RATE						
CaCO3 (lbs/hr)	344,739	828	1,134	824	310	4
CaSO4.2H2O (lbs/hr)	20,875,771	50,140	55,671	50,038	5,633	102
Inerts (lbs/hr)	410,604	986	1,900	957	942	29
Solids (lbs/hr)	21,631,114	51,954	58,705	51,819	6,886	135
Water (lbs/hr)	64,445,742	154,787	197,574	3,349	267,458	224,672
Total Slurry (lbs/hr)	86,076,856	206,741	256,279	55,168	274,344	224,807
Total Slurry (tph)	43,038	103	128	28	137	112
Total Slurry (gpm)	145,900	350	453	na	535	444

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 10-Sept. 92
DOE Test No. 16

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	14.4	100
DENSITY (SGU)	1.012	1.012	1.089	na
FLOW RATE				
CaCO3 (lbs/hr)	1	3	306	29,149
CaSO4.2H2O (lbs/hr)	23	79	5,531	0
Inerts (lbs/hr)	7	22	914	686
Solids (lbs/hr)	31	104	6,751	29,835
Water (lbs/hr)	50,964	173,707	42,786	na
Total Slurry (lbs/hr)	50,995	173,812	49,538	na
Total Slurry (tph)	25	87	25	15
Total Slurry (gpm)	101	343	91	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 11-Sept. 92
DOE Test No. 14R

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	25.4	25.4	23.21	5.82	2.68	0.06
DENSITY (SGU)	1.177	1.177	1.13	na	1.025	1.011
FLOW RATE						
CaCO3 (lbs/hr)	529,444	1,284	2,023	1,276	746	8
CaSO4.2H2O (lbs/hr)	20,887,427	50,655	57,906	50,516	7,390	139
Inerts (lbs/hr)	409,562	993	2,766	954	1,812	39
Solids (lbs/hr)	21,826,433	52,932	62,695	52,747	9,948	186
Water (lbs/hr)	64,104,406	155,463	207,397	3,260	361,245	309,311
Total Slurry (lbs/hr)	85,930,840	208,395	270,091	56,006	371,193	309,497
Total Slurry (tph)	42,965	104	135	28	186	155
Total Slurry (gpm)	145,900	354	478	na	724	612

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 11-Sept. 92
DOE Test No. 14R

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	17	100
DENSITY (SGU)	1.011	1.011	1.107	na
FLOW RATE				
CaCO3 (lbs/hr)	1	6	739	29,448
CaSO4.2H2O (lbs/hr)	24	115	7,251	0
Inerts (lbs/hr)	7	33	1,772	693
Solids (lbs/hr)	32	154	9,762	30,141
Water (lbs/hr)	53,189	256,122	51,934	na
Total Slurry (lbs/hr)	53,221	256,276	61,696	na
Total Slurry (tph)	27	128	31	15
Total Slurry (gpm)	105	507	112	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 14-Sept. 92
DOE Test No. 17A

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	132	132	132	Amb	132	na
SOLIDS CONTENT (%)	25.77	25.77	22.19	5.81	2.27	0.06
DENSITY (SGU)	1.181	1.181	1.13	na	1.023	1.012
FLOW RATE						
CaCO3 (lbs/hr)	219,631	466	739	461	279	5
CaSO4.2H2O (lbs/hr)	23,411,421	49,673	55,017	49,564	5,453	109
Inerts (lbs/hr)	461,794	980	1,689	960	729	20
Solids (lbs/hr)	24,092,846	51,119	57,446	50,985	6,461	134
Water (lbs/hr)	69,398,988	147,248	201,385	3,145	278,161	224,023
Total Slurry (lbs/hr)	93,491,834	198,367	258,830	54,130	284,622	224,158
Total Slurry (tph)	46,746	99	129	27	142	112
Total Slurry (gpm)	158,200	336	458	na	556	443

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 14-Sept. 92
DOE Test No. 17A

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	10.9	100
DENSITY (SGU)	1.012	1.012	1.08	na
FLOW RATE				
CaCO3 (lbs/hr)	1	4	273	28,877
CaSO4.2H2O (lbs/hr)	26	83	5,344	0
Inerts (lbs/hr)	5	15	709	680
Solids (lbs/hr)	32	102	6,326	29,557
Water (lbs/hr)	53,545	170,478	54,137	na
Total Slurry (lbs/hr)	53,578	170,580	60,464	na
Total Slurry (tph)	27	85	30	15
Total Slurry (gpm)	106	337	113	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 15-Sept. 92
DOE Test No. 18

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	133	133	133	Amb	133	na
SOLIDS CONTENT (%)	25.43	25.43	22.27	6.77	2.3	0.06
DENSITY (SGU)	1.18	1.18	1.13	na	1.023	1.012
FLOW RATE						
CaCO3 (lbs/hr)	257,878	524	736	517	219	7
CaSO4.2H2O (lbs/hr)	25,063,516	50,946	57,020	50,824	6,196	122
Inerts (lbs/hr)	490,600	997	1,643	978	665	20
Solids (lbs/hr)	25,811,993	52,468	59,399	52,319	7,080	148
Water (lbs/hr)	75,690,143	153,854	207,358	3,799	300,731	247,227
Total Slurry (lbs/hr)	101,502,137	206,321	266,757	56,118	307,811	247,375
Total Slurry (tph)	50,751	103	133	28	154	124
Total Slurry (gpm)	171,900	349	472	na	601	488

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 15-Sept. 92
DOE Test No. 18

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	12	100
DENSITY (SGU)	1.012	1.012	1.082	na
FLOW RATE				
CaCO3 (lbs/hr)	2	5	212	29,617
CaSO4.2H2O (lbs/hr)	29	93	6,074	0
Inerts (lbs/hr)	5	15	646	697
Solids (lbs/hr)	35	114	6,931	30,314
Water (lbs/hr)	57,999	189,228	53,504	na
Total Slurry (lbs/hr)	58,034	189,341	60,436	na
Total Slurry (lph)	29	95	30	15
Total Slurry (gpm)	115	374	113	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 16-Sept. 92
DOE Test No. 19

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	132	132	132	Amb	132	na
SOLIDS CONTENT (%)	19.1	19.1	17.18	5.9	2.17	0.06
DENSITY (SGU)	1.139	1.139	1.13	na	1.02	1.01
FLOW RATE						
CaCO3 (lbs/hr)	237,170	621	910	613	296	7
CaSO4.2H2O (lbs/hr)	19,182,116	50,188	56,530	50,054	6,476	134
Inerts (lbs/hr)	377,182	987	1,465	970	495	17
Solids (lbs/hr)	19,796,467	51,795	58,904	51,637	7,267	158
Water (lbs/hr)	83,849,959	219,385	283,886	3,238	327,612	263,111
Total Slurry (lbs/hr)	103,646,426	271,180	342,790	54,875	334,879	263,269
Total Slurry (lph)	51,823	136	171	27	167	132
Total Slurry (gpm)	181,850	476	606	na	656	521

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 16-Sept. 92
DOE Test No. 19

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	10.3	100
DENSITY (SGU)	1.01	1.01	1.068	na
FLOW RATE				
CaCO3 (lbs/hr)	1	6	289	29,176
CaSO4.2H2O (lbs/hr)	26	108	6,342	0
Inerts (lbs/hr)	3	14	478	687
Solids (lbs/hr)	31	127	7,109	29,863
Water (lbs/hr)	51,066	212,045	64,501	na
Total Slurry (lbs/hr)	51,096	212,172	71,610	na
Total Slurry (tph)	26	106	36	15
Total Slurry (gpm)	101	420	135	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 21-Sept. 92
DOE Test No. 6R

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	16.5	100
DENSITY (SGU)	1.012	1.012	1.114	na
FLOW RATE				
CaCO3 (lbs/hr)	1	6	1,049	39,659
CaSO4.2H2O (lbs/hr)	28	133	8,850	0
Inerts (lbs/hr)	5	25	2,969	934
Solids (lbs/hr)	34	163	12,868	40,593
Water (lbs/hr)	57,038	272,072	69,982	na
Total Slurry (lbs/hr)	57,072	272,235	82,850	na
Total Slurry (tph)	29	136	41	20
Total Slurry (gpm)	113	538	152	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 23-Sept. 92
DOE Test No. 11A

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	129	129	129	Amb	129	na
SOLIDS CONTENT (%)	23.5	23.5	22.80	6.99	3.28	0.06
DENSITY (SGU)	1.17	1.17	1.13	na	1.028	1.012
FLOW RATE						
CaCO3 (lbs/hr)	912,065	2,312	3,140	2,302	838	10
CaSO4.2H2O (lbs/hr)	22,315,028	56,557	62,448	56,465	5,983	92
Inerts (lbs/hr)	423,764	1,074	2,696	1,047	1,649	27
Solids (lbs/hr)	23,650,858	59,942	68,284	59,814	8,470	128
Water (lbs/hr)	76,991,091	195,131	231,252	4,495	249,764	213,644
Total Slurry (lbs/hr)	100,641,949	255,074	299,536	64,309	258,234	213,772
Total Slurry (tph)	50,321	128	150	32	129	107
Total Slurry (gpm)	171,900	436	530	na	502	422

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 23-Sept. 92
DOE Test No. 11A

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	20.3	100
DENSITY (SGU)	1.012	1.012	1.145	na
FLOW RATE				
CaCO3 (lbs/hr)	2	7	829	32,879
CaSO4.2H2O (lbs/hr)	23	69	5,891	0
Inerts (lbs/hr)	7	20	1,622	774
Solids (lbs/hr)	32	96	8,342	33,653
Water (lbs/hr)	53,900	159,744	36,121	na
Total Slurry (lbs/hr)	53,932	159,840	44,463	na
Total Slurry (tph)	27	80	22	17
Total Slurry (gpm)	107	316	80	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 24-Sept. 92
DOE Test No. 11B

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	129	129	129	Amb	129	na
SOLIDS CONTENT (%)	24.4	24.4	23.09	7.52	2.99	0.06
DENSITY (SGU)	1.179	1.179	1.13	na	1.025	1.011
FLOW RATE						
CaCO3 (lbs/hr)	911,137	2,800	4,193	2,793	1,400	7
CaSO4.2H2O (lbs/hr)	23,416,311	71,964	79,516	71,821	7,695	143
Inerts (lbs/hr)	418,085	1,285	3,085	1,254	1,831	31
Solids (lbs/hr)	24,745,533	76,049	86,794	75,868	10,925	181
Water (lbs/hr)	76,670,585	235,628	289,066	6,169	354,472	301,033
Total Slurry (lbs/hr)	101,416,118	311,677	375,860	82,038	365,397	301,214
Total Slurry (tph)	50,708	156	188	41	183	151
Total Slurry (gpm)	171,900	528	665	na	712	595

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 24-Sept. 92
DOE Test No. 11B

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	17.9	100
DENSITY (SGU)	1.011	1.011	1.129	na
FLOW RATE				
CaCO3 (lbs/hr)	1	6	1,392	41,836
CaSO4.2H2O (lbs/hr)	25	118	7,552	0
Inerts (lbs/hr)	5	25	1,801	985
Solids (lbs/hr)	31	150	10,745	42,821
Water (lbs/hr)	51,824	249,209	53,438	na
Total Slurry (lbs/hr)	51,855	249,359	64,183	na
Total Slurry (tph)	26	125	32	21
Total Slurry (gpm)	103	493	117	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 25-Sept. 92
DOE Test No. 12

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	131	131	131	Amb	131	na
SOLIDS CONTENT (%)	24.5	24.5	23.74	6.81	3.29	0.06
DENSITY (SGU)	1.177	1.177	1.13	na	1.028	1.012
FLOW RATE						
CaCO3 (lbs/hr)	592,713	1,861	2,730	1,852	877	9
CaSO4.2H2O (lbs/hr)	23,790,930	74,687	82,546	74,547	7,999	140
Inerts (lbs/hr)	421,157	1,322	3,227	1,307	1,920	15
Solids (lbs/hr)	24,804,800	77,870	88,502	77,706	10,796	164
Water (lbs/hr)	76,439,281	239,967	284,271	5,679	317,347	273,043
Total Slurry (lbs/hr)	101,244,081	317,838	372,773	83,385	328,143	273,207
Total Slurry (tph)	50,622	159	186	42	164	137
Total Slurry (gpm)	171,900	540	659	na	638	540

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 25-Sept. 92
DOE Test No. 12

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	21	100
DENSITY (SGU)	1.012	1.012	1.15	na
FLOW RATE				
CaCO3 (lbs/hr)	2	7	869	43,419
CaSO4.2H2O (lbs/hr)	26	114	7,858	0
Inerts (lbs/hr)	3	12	1,905	1,022
Solids (lbs/hr)	31	133	10,632	44,441
Water (lbs/hr)	51,470	221,573	44,304	na
Total Slurry (lbs/hr)	51,501	221,706	54,936	na
Total Slurry (lph)	26	111	27	22
Total Slurry (gpm)	102	438	98	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 29-Sept. 92
DOE Test No. 13

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	129	129	129	Amb	129	na
SOLIDS CONTENT (%)	25.17	25.17	22.08	6.84	3.25	0.06
DENSITY (SGU)	1.175	1.175	1.13	na	1.027	1.01
FLOW RATE						
CaCO3 (lbs/hr)	573,036	1,676	2,540	1,666	874	10
CaSO4.2H2O (lbs/hr)	24,429,914	71,472	79,625	71,346	8,280	126
Inerts (lbs/hr)	436,884	1,278	3,706	1,256	2,450	22
Solids (lbs/hr)	25,439,833	74,426	85,871	74,268	11,603	158
Water (lbs/hr)	75,632,210	221,268	302,962	5,453	345,411	263,717
Total Slurry (lbs/hr)	101,072,043	295,694	388,833	79,721	357,014	263,875
Total Slurry (tph)	50,536	148	194	40	179	132
Total Slurry (gpm)	171,900	503	688	na	695	522

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date: 29-Sept. 92
DOE Test No.: 13

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	12.9	100
DENSITY (SGU)	1.01	1.01	1.089	na
FLOW RATE				
CaCO3 (lbs/hr)	2	8	863	41,550
CaSO4.2H2O (lbs/hr)	25	101	8,154	0
Inerts (lbs/hr)	4	18	2,428	978
Solids (lbs/hr)	32	126	11,445	42,528
Water (lbs/hr)	53,187	210,530	81,694	na
Total Slurry (lbs/hr)	53,219	210,656	93,139	na
Total Slurry (tph)	27	105	47	21
Total Slurry (gpm)	105	417	173	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 22-Sept. 92
DOE Test No. 10A

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	130	130	130	Amb	na	130
SOLIDS CONTENT (%)	25.4	25.4	23.45	7.14	3.21	0.06
DENSITY (SGU)	1.18	1.18	1.13	na	1.026	1.012
FLOW RATE						
CaCO3 (lbs/hr)	669,171	1,913	2,811	1,897	915	16
CaSO4.2H2O (lbs/hr)	27,406,975	78,349	88,897	78,158	10,740	192
Inerts (lbs/hr)	480,025	1,372	4,254	1,361	2,893	11
Solids (lbs/hr)	28,556,171	81,635	95,963	81,415	14,547	219
Water (lbs/hr)	83,869,698	239,761	313,291	6,260	438,640	365,110
Total Slurry (lbs/hr)	112,425,869	321,396	409,254	87,675	453,187	365,329
Total Slurry (tph)	56,213	161	205	44	227	183
Total Slurry (gpm)	190,400	544	724	na	883	721

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 22-Sept. 92
DOE Test No. 10A

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	17.3	100
DENSITY (SGU)	1.012	1.012	1.118	na
FLOW RATE				
CaCO3 (lbs/hr)	3	14	898	45,548
CaSO4.2H2O (lbs/hr)	30	162	10,548	0
Inerts (lbs/hr)	2	9	2,882	1,072
Solids (lbs/hr)	34	185	14,328	46,620
Water (lbs/hr)	57,189	307,921	73,530	na
Total Slurry (lbs/hr)	57,224	308,106	87,858	na
Total Slurry (tph)	29	154	44	23
Total Slurry (gpm)	113	608	161	na

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 22-Sept. 92
DOE Test No. 10B

STREAM No.	101 ABSORBER RECIRCULATION	102 ABSORBER BLEED	301 CENTRFUGE FEED	302 GYPSUM CAKE	303 THICKENER FEED	304 THICKENER OVERFLOW
TEMPERATUE (F)	128	128	128	Amb	128	na
SOLIDS CONTENT (%)	24.7	24.7	23.68	6.57	2.76	0.06
DENSITY (SGU)	1.176	1.176	1.13	na	1.026	1.013
FLOW RATE						
CaCO3 (lbs/hr)	674,547	1,471	2,296	1,455	841	16
CaSO4.2H2O (lbs/hr)	26,500,303	57,806	66,613	57,615	8,998	191
Inerts (lbs/hr)	500,206	1,091	2,911	1,080	1,831	11
Solids (lbs/hr)	27,675,057	60,368	71,820	60,150	11,671	218
Water (lbs/hr)	84,369,707	184,037	231,517	4,230	411,174	363,694
Total Slurry (lbs/hr)	112,044,764	244,405	303,338	64,379	422,845	363,912
Total Slurry (lph)	56,022	122	152	32	211	182
Total Slurry (gpm)	190,400	415	536	na	824	718

DEMONSTRATION TEST RESULTS

STREAM DATA SUMMARY - BAILLY AFGD PROJECT

CASE: Test No. 1 ; 3.2 wt % S Coal - WES Out of Service

Date 22-Sept. 92
DOE Test No. 10B

STREAM No.	305 WASTEWATER TREATMENT FEED	306 THICKENER OVERFLOW TO ABSORBER	307 THICKENER UNDERFLOW	501 LIMESTONE FEED RATE
TEMPERATUE (F)	na	na	na	Amb
SOLIDS CONTENT (%)	0.06	0.06	21.1	100
DENSITY (SGU)	1.013	1.013	1.149	na
FLOW RATE				
CaCO3 (lbs/hr)	3	14	825	33,605
CaSO4.2H2O (lbs/hr)	30	161	8,807	0
Inerts (lbs/hr)	2	9	1,820	791
Solids (lbs/hr)	34	184	11,452	34,396
Water (lbs/hr)	56,385	307,309	47,480	na
Total Slurry (lbs/hr)	56,419	307,494	58,933	na
Total Slurry (tph)	28	154	29	17
Total Slurry (gpm)	111	607	106	na

SECTION 6.6 LABORATORY DATA

DATE 9/29/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	900	5.8	50	M-1.186 1.181	25.7	1818	1014	74.7	1734	1.3	6955	9.5	1 / WEEK		
BLEED	L	1500			1.179	26.0	1801	1334	ANALYZ	1744		6391				
PUMP	X								ANALYZ							
	L	2200			1.166	23.8	1649	1169	ANALYZ	1570		6584				
GYPSUM	X	900					23.0%	.15%	1.25%	53.8%		<20	349	1 / WEEK	6.70	20.02
PRODUCT	L	2200					23.1%	.10%	1.45%	53.5%		<20			6.97	20.03
FILTRATE	X	900			1.0245	3.29	235	1188	31.3	193	<0.3	4858	8.1	1 / WEEK		
	L	1500			1.0275	3.26										
SUMP	L															
	L	2200			1.027	3.20	230	1198	19.8	192						
THICKENER	X	900			1.0095	.006	49.4	1142	1.1	46.7	<0.3	5026	9.5	1 / WEEK		
	L	1500			1.012	.015										
OVERFLOW	X															
	L	2200			1.0115	.011										
THICKENER	X	900			1.089	12.9	871	1778	148	679	3.3	4669	7.0	1 / WEEK		
	L	1500			1.138	20.1										
UNDERFLOW	X															
		2200			1.114	16.8										

DAILYRPT.XLS

DATE 9/28/92		PH	TEMP C	DENSITY g/L	DENSITY METER	SOLIDS wt %	Ca mmol/L	CO3 mmol/L	SO3 mmol/L	S mmol/L	Cl ppm
ABSORBER	8:00 ~~7:00~~ AM	6.0	49	1.183	1.186	25.7	1774	45.8	<0.3	1742	6782
FILTRATE SUMP	8:00 ~~7:00~~ AM	7.2	25	1.0225		2.60					
THICKENER U/F	8:00 ~~7:00~~ AM	7.1	26	1.071		10.5	670	60.1		602	
THICKENER O/F	8:00 ~~7:00~~ AM	7.2	25	1.010		.007	48.1	0.7		45.2	4996
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	8:00 ~~7:00~~ AM	8.62	5.85	20.13	22.8	.85	53.7	<20			

DAILYRPT.XLS

DATE 9/27/92		PH	TEMP C	DENSITY g/L	DENSITY METER	SOLIDS wt %	Ca mmol/L	CO3 mmol/L	SO3 mmol/L	S mmol/L	Cl ppm
ABSORBER	9:00 ~~7:00~~ AM	Meter 6.01		1.176	1.176	24.3	1686	54.4	—	1640	7433
FILTRATE SUMP	7:00 AM	—	—	—		—					
THICKENER U/F	7:00 AM	—	—	—		—	—	—		—	
THICKENER O/F	7:00 AM	—	—	—		—	—	—		—	—
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	9:00 ~~7:00~~ AM	8.41	7.16	20.02	22.9	1.07	53.9	63			

DAILYRPT.XLS

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
9/26/92			C	g/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	0800 ~~7:00 AM~~	5.94	52.4	1.172	1.178	24.2	1659	43.4	<0.3	1617	7965
FILTRATE SUMP	0800 ~~7:00 AM~~	6.9	29	1.025		2.84					
THICKENER U/F	0800 ~~7:00 AM~~	6.9	25.5	1.063		9.07	580	93.3		455	
THICKENER O/F	0800 ~~7:00 AM~~	6.9	27	1.011		.021	53.7	0.84		49.7	5422
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	0800 ~~7:00 AM~~	8.58	6.90	19.80	23.0	1.59	53.3	<20			

			X	X	X	X			X		X	X				
DATE 9/25/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	900			1.175	24.3	1747	1464	83.1	1664	<0.3	7875	9.5	1 / WEEK		
BLEED	L	1400			1.175	24.1	1692	1532	ANALYZ	1614		7766				
PUMP	X								ANALYZ							
	L	1900			1.181	25.0	1768	1830	ANALYZ	1696		7086				
GYPSUM	X	900	8.44				23.2%	.10%	1.63%	52.8%		<20	279	1 / WEEK	6.57	19.50
PRODUCT	L	1900					23.1%	.10%	1.46%	53.0%		23			7.05	19.71
FILTRATE	X	900			1.026	3.32	244	1299	27.9	202	0.05	6225	7.9	1 / WEEK		
	L	1400			1.029	3.26										
SUMP	L															
	L	1900			1.031	3.52	263	1241	33.5	217						
THICKENER	X	900			1.010	.010	55.1	1255	0.89	50.3	<0.3	6160	9.2	1 / WEEK		
	L	1400			1.013	.017										
OVERFLOW	X															
	L	1900			1.013	.013										
THICKENER	X	900			1.150	21.0	1442	1966	190	1205	1.4	5309	6.5	1 / WEEK		
	L	1400			1.144	20.4										
UNDERFLOW	X															
		1900			1.133	19.3										

			X	X	X	X			X		X	X				
DATE 9/24/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1100	5.9	54	M- 1.188 1.181	25.2	1800	1611	129.6	1673	<0.3	7844	9.2	1 / WEEK		
BLEED	L	1500			1.173	23.7	1714	1160	ANALYZ	1570		7834				
PUMP	X								ANALYZ							
	L	2100			1.183	24.4	1763	1425	ANALYZ	1640		7485				
GYPSUM	X	900					23.2%	.10%	2.32%	52.4%	13 ppm	31	237	1 / WEEK	7.78	19.51
PRODUCT	L	2100					23.6%	.14%	2.36%	50.4%		27			7.26	remick R.27 19.07
	X	1100			1.023	3.00	232	1196	39.6	174	0.5	5764	7.9	1 / WEEK		
FILTRATE	L	1500			1.0265	2.97										
SUMP	L															
	L	2100			1.0305	3.72	266	1483	55.5	200						
	X	1100			1.009	.004	47.6	1146	0.7	46.4	<0.3	5215	8.9	1 / WEEK		
THICKENER	L	1500			1.012	.019										
OVERFLOW	X															
	L	2100			1.012	.007										
	X	1100			1.129	17.9	1314	2211	376	825	3.7	4812	6.6	1 / WEEK		
THICKENER	L	1500			1.217	29.6										
UNDERFLOW	X															
		2100			1.155	21.8										

			X	X	X	X			X		X	X				
DATE 9/23/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800	6.0	54	M-1.177 1.163	22.4	1577	1605	108	1442	<0.3	7687	9.8	1 / WEEK		
BLEED	L	1500			1.169	23.4	1722	1423	ANALYZ	1583		7649				
PUMP	X								ANALYZ							
	L	2200			1.178	24.7	1763	1262	ANALYZ	1633		7441				
GYPSUM	X	800	8.32				23.0%	.10%	2.03%	51.9%		<20	252	1 / WEEK	7.02	19.63
PRODUCT	L	2200					23.1%	.10%	1.86%	52.6%		26			6.96	19.65
	X	800			1.026	2.84	237	1401	34.2	192	<0.3	6009	8.4	1 / WEEK		
FILTRATE	L	1500			1.030	3.71										
SUMP	L															
	L	2200			1.030	3.55	266	1206		200						
	X	800			1.011	.018	55.6	1263	1.3	52.0	<0.3	6101	9.9	1 / WEEK		
THICKENER	L	1500			1.013	.012										
OVERFLOW	X															
	L	2200			1.0125	.011										
	X	800			1.145	20.3	1407	1991	212	1144	2.6	5183	6.8	1 / WEEK		
THICKENER	L	1500			1.095	13.8										
UNDERFLOW	X															
		2200			1.112	10.1										

			X	X	X	X			X		X	X				
DATE 9/22/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800	5.9	54	M-1.187 1.183	25.5	1802	1490	72.9	1721	1.0	8135	9.8	1 / WEEK		
BLEED	L	1200			1.178	25.3	1753	1700	ANALYZ	1695		7067				
PUMP	X								ANALYZ							
	L	1600			1.176	24.7	1728	1503	ANALYZ	1664		7183				
GYPSUM	X	800	8.46				22.8%	.10%	1.59%	52.6%		35	264	1 / WEEK	7.14	19.73
PRODUCT	L	1600					22.9%	.10%	1.56%	53.3%		<20			6.57	19.82
	X	800			1.0255	3.21	224	1329	21.1	196	1.4	5625	8.3	1 / WEEK		
FILTRATE	L	1200			1.0265	2.83										
SUMP	L															
	L	1600			1.0265	2.76	208	1321	20.8	176						
	X	800			1.0115	.019	52.3	1184	1.3	51.4	0.7	5573	9.8	1 / WEEK		
THICKENER	L	1200			1.014	.054										
OVERFLOW	X															
	L	1600			1.013	.033										
	X	800			1.118	17.3	1101	1734	115	969	1.2	5136	6.8	1 / WEEK		
THICKENER	L	1200			1.155	22.7										
UNDERFLOW	X															
		1600			1.149	21.1										

			X	X	X	X			X		X	X				
DATE 9/21/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800	6.0	55	M-1.181 1.168	23.3	1614	1588	73.0	1549	<0.3	8019	9.6	1 / WEEK		
BLEED	L	1400			1.171	23.7	1671	1618	ANALYZ	1617		8247				
PUMP	X								ANALYZ							
	L	2200			1.181	25.8	1816	1401	ANALYZ	1738		7844				
GYPSUM	X	800	8.71				22.9%	.15%	1.50%	53.1%		49	275	1 / WEEK	7.77	19.77
PRODUCT	L	2200					23.0%	.10%	1.59%	53.5 %		84			6.90	19.68
	X	800			1.0255	3.35	220	1473		182	<0.3	5922	8.1	1 / WEEK		
FILTRATE	L	1400			1.0295	3.33										
SUMP	L															
	L	2200			1.027	2.82	218	1408	26.8	180						
	X	800			1.012	.008	50.8	1105	0.6	47.8	<0.3	5890	9.8	1 / WEEK		
THICKENER	L	1400			1.014	.024										
OVERFLOW	X															
	L	2200			1.014	.010										
	X	800			1.114	16.5	1037	1429	132	840		5282	6.6	1 / WEEK		
THICKENER	L	1400			1.173	24.9										
UNDERFLOW	X															
		2200			1.081	12.1										

DAILYRPT.XLS

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
9/20/92			C	g/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	7:00 AM	—	—	1.175	—	23.8	1661	78.6	—	1643	8320
FILTRATE SUMP	7:00 AM	—	—	—		—					
THICKENER U/F	7:00 AM	—	—	—		—	—	—		—	
THICKENER O/F	7:00 AM	—	—	—		—	—	—		—	—
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	7:00 AM	8.66	6.60	19.80	22.9	1.37	52.8	77			

DATE 9/19/92		PH	TEMP C	DENSITY g/L	DENSITY METER	SOLIDS wt %	Ca mmol/L	CO3 mmol/L	SO3 mmol/L	S mmol/L	Cl ppm
ABSORBER	0800 ~~7:00 AM~~	5.9	54	1.154	1.189	21.9	1509	59.8	<0.3	1455	7247
FILTRATE SUMP	0800 ~~7:00 AM~~	6.8	26.5	1.022		2.03					
THICKENER U/F	0800 ~~7:00 AM~~	7.0	25	1.107		15.5	994	196		753	
THICKENER O/F	0800 ~~7:00 AM~~	7.0	24	1.013		<.002	49.2	0.40		49.3	4961
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	0800 ~~7:00 AM~~	8.44	5.56	19.93	22.8	1.10	53.7	15.8			

DATE 9/18/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1100	5.4	50	M-1.184 1.165	23.1	1547	1199	31.4	1544	5.0	7349	10.2	1 / WEEK		
BLEED	L	1500			1.154	22.0	1493	1346	ANALYZ	1472	7.6	7620				
PUMP	X	1800							ANALYZ		7.0					
	L	2200			1.175	24.4	1662	1463	ANALYZ	1663		7551				
GYPSUM	X	1100	8.34				22.6%	.10%	.62%	54.0%		<20	204	1 / WEEK	6.48	20.12
PRODUCT	L	2200					22.5%	.10%	.60%	53.8%		<20			6.32	20.18
FILTRATE	X	1100			1.0225	2.47	196	1411	7.5	188	1.4	5672	8.9	1 / WEEK		
	L	1500			1.023	2.18										
SUMP	L	—	—		—	—										
	L	2200			1.023	2.23	155	1148	7.4	137						
THICKENER	X	1100			1.0105	.033	49.0	1203	0.8	49.3	0.6	5668	11.2	1 / WEEK		
	L	1500			1.0125	.016										
OVERFLOW	X	—			—	—										
	L	2200			1.012	.004										
THICKENER	X	1100			1.098	14.6	880	1392	30.1	860	2.8	5167	7.1	1 / WEEK		
	L	1500			1.067	10.1										
UNDERFLOW	X	—			—	—										
	L	2200			1.088	12.7										

DATE 9/17/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1200	5.5	56	M-1.176 1.189	26.8	1851	1140	24.7	1846	<0.3	7482	11.4	1 / WEEK		
BLEED	L								ANALYZ							
PUMP	X								ANALYZ							
	L	2200			1.183	25.8	1757	1580	ANALYZ	1767		7890				
GYPSUM	X	800	8.38				22.7%	.10%	.67%	54.1%		<20	278	1 / WEEK	5.71	20.01
PRODUCT	L	2200					22.6%	.09%	.57%	54.1%		<20			6.00	20.14
FILTRATE	X	1200			1.0215	2.79	190	1290	8.5	170	<0.3	5297	8.6	1 / WEEK		
	L															
SUMP	L															
	L	2200			1.0260	2.62	199	1177	9.2	182						
THICKENER	X	1200			1.010	.014	49.5	1241	0.7	49.0	<0.3	R = 6336 5533	10.6	1 / WEEK		
	L															
OVERFLOW	X															
	L	2200			1.0130	.007										
THICKENER	X	1200			1.067	9.35	570	1923	52.7	494	1.3	5002	6.3	1 / WEEK		
	L															
UNDERFLOW	X															
		2200			1.078	11.5										

DATE 9/16/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1500	5.7	56	meter 1.170 1.166	22.4	1664	1133	33.0	1646	<0.3	7790	10.8	1/WEEK		
BLEED	L								ANALYZ							
PUMP	X								ANALYZ							
	L	2000			1.112	15.8	1067	1350	ANALYZ	1042		6788				
GYPSUM	X	800	8.29				22.6%	.05%	.58%	54.4%		148	279	1/WEEK	6.15	20.08
PRODUCT	L	2000					22.7%	.10%	.64%	54.2%		34			5.66	20.05
FILTRATE	X	1500			1.018	2.66	166	1205	9.5	148	<0.3	5709	9.1	1/WEEK		
	L															
SUMP	L															
	L	2000			1.0245	1.67	182	1220	8.9	170						
THICKENER	X	1500			1.010	.048	49.4	1286	0.8	49.6	<0.3	5733	10.9	1/WEEK		
	L															
OVERFLOW	X															
	L	2000			1.013	<.002										
THICKENER	X	1500			1.068	10.3	613	1395	40.4	552	1.7	5486	7.2	1/WEEK		
	L															
UNDERFLOW	X															
		2000			1.080	11.0										

			X	X	X	X			X		X	X				
DATE 9/15/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F- ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800	5.7		1.184	25.9	1798	1438	37.1	1783	0.4	7518	9.5	1 / WEEK		
BLEED	L	1300			1.182	25.9	1777	1443	ANALYZ	1763		7844				
PUMP	X								ANALYZ							
	L	2000			1.173	24.5	1665	1341	ANALYZ	1647		7566				
GYPSUM	X	800	8.35				22.3%	.11%	.81 %	52.5%		90.0	331	1 / WEEK	6.43	20.04
PRODUCT	L	2000					22.7%	.05%	.56%	53.7%		93.1			7.11	20.15
	X	800			1.021	2.12	177	1137	6.9	159	<0.3	5478	9.2	1 / WEEK		
FILTRATE	L	1300			1.024	2.34										
SUMP	L															
	L	2000			1.025	2.44	187	1400	7.8	173						
	X	800			1.012	.009	48.8	1269	0.8	48.3	<0.3	5523	10.3	1 / WEEK		
THICKENER	L	1300			1.0135	.004										
OVERFLOW	X															
	L	2000			1.013	.010										
	X	800			1.082	12.0	747	1548	60.3	658	1.7	4888	6.9	1 / WEEK		
THICKENER	L	1300			1.099	14.6										
UNDERFLOW	X															
		2000			1.121	17.9										

			X	X	X	X			X		X	X				
DATE 9/14/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800	5.9	54	1.177	25.1	1720	1420	32.7	1702	<0.3	8040	9.6	1 / WEEK		
BLEED	L	1500			1.188	26.0	1771	1208	ANALYZ	1769		7766				
PUMP	X								ANALYZ							
	L	2000			1.177	26.2	1718	1207	ANALYZ	1709		7046				
GYPSUM	X	800	8.54				22.8%	.10%	.74%	53.9%		50.8	269	1 / WEEK	5.74	20.02
PRODUCT	L	2000					22.8%	.05%	.93%	54.1%		63.1			5.88	20.01
	X	800			1.024	2.92	208	1265	12.2	184	<0.3	5255	8.1	1 / WEEK		
FILTRATE	L	1500			1.0225	1.99										
SUMP	L															
	L	2000			1.0225	1.90	143	1215	8.1	132						
	X	800			1.012	.005	48.4	1211	0.68	47.6	<0.3	5443	10.1	1 / WEEK		
THICKENER	L	1500			1.0125	.006										
OVERFLOW	X															
	L	2000			1.0130	.006										
	X	800			1.080	10.9	738	1203	55.9	660.	0.5	5000	6.6	1 / WEEK		
THICKENER	L	1500			1.124	19.0										
UNDERFLOW	X															
		2000			1.067	10.0										

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
9/13/92			C	g/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	0800 ~~7:00 AM~~	5.95	51.5	1.182	1.181	24.7	1760	56.3	0.9	1712	8196
FILTRATE SUMP	7:00 AM										
THICKENER U/F	7:00 AM										
THICKENER O/F	7:00 AM										
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	0800 ~~7:00 AM~~	8.64	6.62	20.04	22.6	0.82	53.6	74.1			

DATE 9/12/92		PH	TEMP C	DENSITY g/L	DENSITY METER	SOLIDS wt %	Ca mmol/L	CO3 mmol/L	SO3 mmol/L	S mmol/L	Cl ppm
ABSORBER	0800 ~~7:00 AM~~			1.177		25.2	1750	39.8		1714	8170
FILTRATE SUMP	0800 ~~7:00 AM~~	7.1	24	1.0255		2.93					
THICKENER U/F	0800 ~~7:00 AM~~	7.0	24	1.074		10.5	679	87.2		541	
THICKENER O/F	0800 ~~7:00 AM~~	6.9	23	1.013		.004	48.3	0.71		47.2	5229
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	0800 ~~7:00 AM~~	8.46	5.77	19.94	22.9	1.13	53.7	54.2			

			X	X	X	X			X		X	X				
DATE 9/11/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800	5.9	53	wtr-1.169 1.180	25.9	1709	1546	76.9	1643	.55	7428	9.1	1 / WEEK		
BLEED	L	1500			1.178	25.2	1774	1284	ANALYZ	1697		7841				
PUMP	X								ANALYZ							
	L	2200			1.174	25.1	1738	1613	ANALYZ	1671		7605				
GYPSUM	X	800	8.64				22.7%	.10%	1.06%	53.7%		10.8	254	1 / WEEK	5.83	19.89 *
PRODUCT	L	2200					22.9%	.10%	1.49%	53.1%		32.7			5.81	19.76 *
	X	800			1.022	2.37	172	1322	17.1	143	.35	4814	8.2	1 / WEEK		
FILTRATE	L	1500			1.025	2.73										
SUMP	L															
	L	2200			1.0285	2.94	217	1467	25.0	186						
	X	800			1.011	.041	46.6	1121	0.7	43.9	<0.3	4252	9.9	1 / WEEK		
THICKENER	L	1500			1.013	.014										
OVERFLOW	X															
	L	2200			1.013	.007										
	X	800			1.107	17.0	1038	1536	102	907	2.15	4072	6.3	1 / WEEK		
THICKENER	L	1500			1.119	17.4										
UNDERFLOW	X															
		2200			1.091	12.9										

ATE 0/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ORBER	X	800			1.179	25.4	1665	1680	50.2	1640	<0.3	6650	10.0	1 / WEEK		
	L	1200			1.177	24.4	1641	1412	ANALYZ	1601		7263				
ED	X								ANALYZ							
MP	L	2200			1.181	25.6	1709	1325	ANALYZ	1667		6564				
							22.8%	.05%	.86%	54.7%		13.9	338	1 / WEEK	6.18	20.09
GYPSUM	X	800	8.38				22.8%	.05%	.93%	53.7%		17.8			5.96	
PRODUCT	L	2200			1.024	2.56	195	1097	12.9	176	<0.3	5009	8.5	1 / WEEK		
FILTRATE	X	800			tr 1.026	2.60										
	L	1200														
SUMP	L				1.023	2.37	183	1060	10.6	163						
	L	2200			1.0120	.026	46.7	1145	0.5	44.5	<0.3	5088	10.3	1 / WEEK		
THICKENER	X	800			1.0125	.012										
	L	1200														
OVERFLOW	X				1.0120	.016										
	L	2200			1.089	14.4	876	1448	57.4	805	0.3	4520	6.8	1 / WEEK		
	X	800			1.089	13.1										
THICKENER	L	1200														
FLOW	X				1.076	11.9										

			X	X	X	X			X		X	X				
DATE 9/9/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F- ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800			1.182	24.5	1677	1177	28.6	1653	<0.3	7370	9.5	1 / WEEK		
BLEED	L	1200	5.8	53	1.167 1.185	25.3	1783	1463	ANALYZ	1768		8001				
PUMP	X								ANALYZ							
	L	2200			1.184	25.6	1796	1536	ANALYZ	1808		6781				
GYPSUM	X	800	8.32				23.1%	.10%	1.50%	53.4%		17.4	365	1 / WEEK	6.25	19.80
PRODUCT	L	2200					22.8%	.11%	.79%	54.7%		12.9			6.40	20.11
	X	800			1.022	2.43	190	1223	19.3	157	0.6	4811	7.9	1 / WEEK		
FILTRATE	L	1200			1.022	2.11										
SUMP	L															
	L	2200			1.023	2.38	190	1270	10.6	173						
	X	800			1.012	.009	45.8	1099	0.8	41.5	<0.3	5082	8.7	1 / WEEK		
THICKENER	L	1200			1.0115	.027										
OVERFLOW	X															
	L	2200			1.012	.008										
	X	800			1.068	10.6	662	1648	77.5	554	2.6	4443	6.8	1 / WEEK		
THICKENER	L	1200			1.076	11.9										
UNDERFLOW	X															
		200			1.062	10.0										

			X	X	X	X			X		X	X				
DATE 9/8/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800			1.166	23.8	1659	1514	83.1	1582	0.7	7993	8.7	1 / WEEK		
BLEED	L	1400	5.9	54	meter 1.172 1.172	24.0	1683	1464	ANALYZ	1610		7597				
PUMP	X								ANALYZ							
	L	1700			1.165	24.3	1652	1298	ANALYZ	1559		8128				
GYPSUM	X	800	8.40				23.1%	.10%	1.47%	53.8%		30.2	371	1 / WEEK	6.60	19.87
PRODUCT	L						No	sample								
	X	800			1.024	2.48	199	1405	19.1	161	0.3	5351	7.9	1 / WEEK		
FILTRATE	L	1400			1.026	2.81										
SUMP	L															
	L	1700			1.024	2.51	183	1571	23.1	147						
	X	800			1.012	<.002	48.7	1120	0.7	43.5	<0.3	5250	9.1	1 / WEEK		
THICKENER	L	1400			1.0125	.008										
OVERFLOW	X															
	L	1700			1.0125	.010										
	X	800			1.114	16.2	1146	1700	105.5	988	1.7	4678	6.8	1 / WEEK		
THICKENER	L	1400			1.090	12.7										
UNDERFLOW	X															
	L	700			1.090	14.3										

DAILYRPT.XLS

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
9/7/92			C	g/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	7:00 AM			1.180		25.1	1771	67.1		1704	7373
FILTRATE SUMP	7:00 AM										
THICKENER U/F	7:00 AM										
THICKENER O/F	7:00 AM										
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	7:00 AM	8.56	7.08	19.95	23.1	1.30	53.8	53.4			

DAILYRPT.XLS

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
9/6/92			C	g/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	0800 ~~7:00~~ AM	5.8	55	1.170	1.165	24.1	1664	63.5	<0.3	1614	8046
FILTRATE SUMP	0800 ~~7:00 AM~~	6.8	27	1.0215		2.27					
THICKENER U/F	0800 ~~7:00 AM~~	7.2	26	1.103		15.5	1018	164		807	
THICKENER O/F	0800 ~~7:00 AM~~	7.0	26	1.011		.047	48.8	.68		40.2	5342
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	0800 ~~7:00 AM~~	8.42	6.36	19.89	23.0	1.33	53.1	17.48			

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
9/5/92			C	g/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	0800 ~~7:00 AM~~			1.171		24.1	1687	74.2		1624	7983
FILTRATE SUMP	0800 ~~7:00 AM~~	6.8	23	1.0225		2.20					
THICKENER U/F	0800 ~~7:00 AM~~	6.9	23	1.090		13.3	879	132		730	
THICKENER O/F	0800 ~~7:00 AM~~	6.9	22	1.012		.023	48.3	.63		41.3	5149
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	0800 ~~7:00 AM~~	8.48	6.28	19.87	23.2	1.45	53.8	15.74			

			X	X	X	X			X		X	X				
DATE 9/4/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1100	5.9	53	1.176	25.0	1689	1396	81.3	1604	3.65	6847	9.1	1 / WEEK		
BLEED	L	1600			1.171	23.4	1700	1248	ANALYZ	1596		7649				
PUMP	X								ANALYZ							
	L	2200			1.160	22.8	1655	1230	ANALYZ	1568		8024				
GYPSUM	X	800	8.34				23.2%	.10%	1.45%	53.8%		16.7	407	1 / WEEK	6.43	19.94
PRODUCT	L	2200					23.2%	.10%	1.50%	53.1%		17.2			7.33	19.85
	X	1100			1.023	2.92	223	1082	20.0	185	2.45	5094	8.0	1 / WEEK		
FILTRATE	L	1600			1.021	2.36										
SUMP	L															
	L	2200			1.021	1.69	146	840	11.9	112						
	X	1100			1.0105	.015	53.4	993	1.3	41.6	1.1	5026	8.9	1 / WEEK		
THICKENER	L	1600			1.0105	.047										
OVERFLOW	X															
	L	2200			1.014	.166										
	X	1100			1.111	16.8	1106	1260	149	922	2.35	4204	7.1	1 / WEEK		
THICKENER	L	1600			1.127	18.8										
UNDERFLOW	X															
		2200			1.386	48.7										

			X	X	X	X			X		X	X				
DATE 9/3/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800			1.185	25.8	1826	1268	76.6	1748	2.1	7491	8.6	1 / WEEK		
BLEED	L	1200	5.9	55	meter 1.201 1.199	27.4	2014	1345	ANALYZ	1941		6857				
PUMP	X								ANALYZ							
	L	2200			1.177	25.3	1778	1530	ANALYZ	1718		7185				
GYPSUM	X	800	8.51				23.3%	.11%	1.65%	52.9%		16.3	384	1 / WEEK	8.31	19.81
PRODUCT	L	2200					23.4%	.05%	1.48%	53.9%		18.3			7.70	19.93
	X	800			1.021	2.45	178	1029	22.5	146	.65	4803	8.5	1 / WEEK		
FILTRATE	L	1200			1.022	2.60										
SUMP	L															
	L	2200			1.0255	2.52	195	1338	20.1	169						
	X	800			1.0105	.022	44.6	951	1.0	38.8	<0.3	4910	8.7	1 / WEEK		
THICKENER	L	1200			1.011	.011										
OVERFLOW	X															
	L	2200			1.0135	.038										
	X	800			1.074	11.4	770	1136	85.8	664	1.55	4474	7.8	1 / WEEK		
THICKENER	L	1200			1.082	12.2										
UNDERFLOW	X															
		2200			1.107	15.5										

			X	X	X	X			X		X	X				
DATE 9/2/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1000	6.0	49	1.178 1.179	24.8	1755	1093	85.0	1665	<0.3	6327	8.9	1 / WEEK		
BLEED	L	1300			1.177	23.6	1694	1371	75.3 ANALYZ	1621		6196				
PUMP	X								ANALYZ							
	L	1700			1.179	24.9	1737	1482	81.9 ANALYZ	1656		6505				
GYPSUM	X	800	8.56				23.2%	.15%	1.81%	53.8%		16.9	404	1 / WEEK	6.67	19.70
PRODUCT	L	1700					23.2%	.10%	1.38%	53.8%		22.3			5.73	19.97
	X	1000			1.0215	2.61	208	1177	18.7	178	<0.3	4951	8.3	1 / WEEK		
FILTRATE	L	1300			1.823	2.58										
SUMP	L															
	L	1700			1.026	3.09	219	1112	26.8	180						
	X	1000			1.010	.050	52.1	1109	2.0	42.4	<0.3	4831	9.1	1 / WEEK		
THICKENER	L	1300			1.0115	.013										
OVERFLOW	X															
	L	1700			1.013	.009										
	X	1000			1.119	16.7	1154	1171	130	1009	1.3	4491	7.6	1 / WEEK		
THICKENER	L	1300			1.111	16.9										
UNDERFLOW	X															
	L	700			1.067	10.3										

			X	X	X	X			X		X	X				
DATE 9/1/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	0700	5.8	54	meter- 1.186 / 1.176	24.8	1766	1168	81.7	1681	2.4	6746	8.80	1 / WEEK		
BLEED	L	1200	6.0		1.179	25.1	1813	1415	72.1 ANALYZ	1745		6687				
PUMP	X								ANALYZ							
	L	2000			1.176	24.4	1709	1335	73.8 ANALYZ	1634		6373				
GYPSUM	X	0700					22.9%	.20%	1.45%	53.27%		16.6	379	1 / WEEK	5.23	19.97
PRODUCT	L	2000					23.1%	.10%	1.80	53.8%		15.0			6.90	19.77
	X	0700			1.022	2.28	196	934	17.9	158	0.8	4663	8.52	1 / WEEK		
FILTRATE	L	1200			1.0245	2.57										
SUMP	L															
	L	2000			1.024	2.11	194	1061	21.3	151						
	X	0700			1.0115	.037	51.2	993	2.26	41.7	0.55	4805	9.22	1 / WEEK		
THICKENER	L	1200			1.0115	.031										
OVERFLOW	X															
	L	2000			1.0125	.013										
	X	0700			1.135	20.5	1360	1138	153	1197	1.6	4263	7.76	1 / WEEK		
THICKENER	L	1200			1.154	22.5										
UNDERFLOW	X															
		2000			1.095	13.9										

			X	X	X	X			X		X	X				
DATE 8/31/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1000	5.9	51	meter 1.169 1.180	25.4	1738	1441	82.7	1658	2.45	6638	8.9	1 / WEEK		
BLEED	L								ANALYZ							
PUMP	X								ANALYZ							
	L								ANALYZ							
GYPSUM	X	800	8.55				23.1%	.10%	1.35%	54.1%		14.7	414	1 / WEEK	5.35	19.23
PRODUCT	L															
	X	1000			1.022	2.68	203	1265	21.8	173	0.6	4537	8.1	1 / WEEK		
FILTRATE	L															
SUMP	L															
	L															
	X	1000			1.010	.045	48.8	1027	2.3	41.6	<0.3	4512	8.9	1 / WEEK		
THICKENER	L															
OVERFLOW	X															
	L															
	X	1000			1.130	19.1	1278	1434	142	1123	3.8	4168	7.2	1 / WEEK		
THICKENER	L															
UNDERFLOW	X															

DAILYRPT.XLS

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
8/30/92			C	g/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	9:00 ~~7:00~~ AM	5.65	55	1.178	1.190	24.5	1714	63.1	1.0	1670	7017
FILTRATE SUMP	9:00 ~~7:00~~ AM	6.88	33	1.0175		1.63					
THICKENER U/F	9:00 ~~7:00~~ AM	6.87	33	1.075		10.8	728	87.9		626	
THICKENER O/F	9:00 ~~7:00~~ AM	6.95	28	1.0105		.012	50.9	0.96		41.3	5043
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	9:00 ~~7:00~~ AM	8.42	5.77	20.07	23.2	1.14	53.9	19.6			

DAILYRPT.XLS

DATE		PH	TEMP C	DENSITY g/L	DENSITY METER	SOLIDS wt %	Ca mmol/L	CO3 mmol/L	SO3 mmol/L	S mmol/L	Cl ppm
8/29/92											
ABSORBER	0800 ~~7:00~~ AM	5.9	55	1.178		25.6	1715	39.0	1.6	1691	6340
FILTRATE SUMP	0800 ~~7:00~~ AM	6.9	32	1.0215		2.42					
THICKENER U/F	0800 ~~7:00~~ AM	6.9	32	1.110		16.4	1079	137		928	
THICKENER O/F	0800 ~~7:00~~ AM	6.9	31	1.010		.006	48.7	0.9		40.3	4954
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	0800 ~~2:00~~ AM	8.46	4.22	19.86	23.0	1.57	52.6	50.0			

			X	X	X	X			X		X	X				
DATE 8/28/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	900	5.9	55	1.172 / 1.175	24.8	1752	1460	159	1588	<0.3	6450	9.0	1 / WEEK		
BLEED	L	1300			1.175	25.0	1769	1390	ANALYZ	1624		6599				
PUMP	X								ANALYZ							
	L	1700			1.178	24.9	1767	1458	ANALYZ	1640		6418				
GYPSUM	X	900	8.54				23.4%	.20 %	2.72 %	52.8%		65.9	374	1 / WEEK	6.79	19.55
PRODUCT	L	1700					23.5%	.11%	2.69%	52.3%		36.7			7.89	19.33
FILTRATE	X	900			1.026	3.43	260	984	42.7	200	0.45	4149	7.9	1 / WEEK		
	L	1300			1.025	3.07										
SUMP	L															
	L	1700			1.026	2.69	226	1219	37.9	172						
THICKENER	X	900			1.0095	.021	48.6	1024	2.0	41.6	<0.3	4865	9.1	1 / WEEK		
	L	1300			1.0105	<.002										
OVERFLOW	X															
	L	1700			1.0115	<.002										
THICKENER	X	900			1.212	29.9	2188	1371	323	1804	<0.3	4033	7.5	1 / WEEK		
	L	1300			1.157	22.7										
UNDERFLOW	X															
		1700			1.128	19.2										

DATE 8/27/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1300	5.9	55	meter 1.187 1.191	25.5	1776	1331	125	1653	0.95	7766	8.8	1 / WEEK		
BLEED	L	1700			1.181	26.1	1810	1293	ANALYZ	1705		6604				
PUMP	X								ANALYZ							
	L	2100			1.174	25.8	1797	1134	ANALYZ	1681		5731				
GYPSUM	X	1300	8.59				22.9%	0.15%	.60%	54.6%		Pile 1700 18.6	330	1 / WEEK	5.66	20.33
PRODUCT	L	2100					23.1%	.05%	1.15%	54.1%		57.0			4.24	20.08
	X	1300			1.021	2.26	180	904	20.7	136	0.2	5712	8.2	1 / WEEK		
FILTRATE	L	1700			F 1.023	2.69										
SUMP	L															
	L	2100			1.0235	2.80	206	978	34.9	159						
	X	1300			1.010	.018	45.8	1010	1.39	40.1	0.1	5600	8.9	1 / WEEK		
THICKENER	L	1700			1.008	.010										
OVERFLOW	X															
	L	2100			1.0115	.004										
	X	1300			1.101	15.3	1034	961	169	777	0.45	5094	7.0	1 / WEEK		
THICKENER	L	1700			1.158	23.9										
UNDERFLOW	X															
	l	2100			1.144	22.5										

DATE 8/26/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	900	Meter 5.98 5.72	55	Meter 1.185 1.175	25.6	1815	1303	Meter 25.[illegible] 25.7	1804	.45	7331	7.5	1 / WEEK		
BLEED	L	1400			1.177	25.0	1740	1283	29.0 ANALYZ	1696		7674				
PUMP	X	~~1800~~							ANALYZ							
	L	2200			1.176	25.4	1761	1321	34.0 ANALYZ	1744		7663				
GYPSUM	X	900	8.43				23.1%	.09%	.50%	54.9%		16.2	372	1 / WEEK	4.62	20.28
PRODUCT	L	1800					22.9%	.10%	.71%	54.3%		14.98			5.12	20.28
	X	900			1.0155	1.73	133	772	2.6	120	0.9	4895	7.2	1 / WEEK		
FILTRATE	L	1400			1.017	1.57										
SUMP	L	~~1800~~														
	L	2200			1.012	0.60	78.8	828	1.7	64.6						
	X	900			1.008	.018	43.9	915	0.3	38.5	.55	4266	7.6	1 / WEEK		
THICKENER	L	1400			1.011	.061										
OVERFLOW	X	~~1800~~														
	L	2200			1.010	.006										
	X	900			1.064	9.95	618	1196	12.0	599	.95	4680	6.3	1 / WEEK		
THICKENER	L	1400			1.036	5.70										
UNDERFLOW	X	~~1800~~														
	L	2200			1.120	18.16										

DATE 8/25/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	800	5.68	55.1	meter - 1.178 1.186	26.9	1755	1305	25.5	1742	0.95	6876	7.3	1 / WEEK		
BLEED	L	1200	meter 6.09		1.176	25.3	1710	1359	28.0 ANALYZ	1695		6980				
PUMP	X	~~1700~~	~~6.07~~						~~26.0~~ ANALYZ							
	L	1700	meter 6.07		1.176	24.4	1716	1104	26.0 ANALYZ	1688		6347				
GYPSUM	X	800	8.60				23.1%	.10%	.58%	55.0%		13.6	432	1 / WEEK	5.68	20.28
PRODUCT	L	1700					22.7%	.09%	.37%	54.5%		12.9			5.93	20.34
	X	800			1.0205	2.23	162	1203	5.7	143	0.65	5094	6.8	1 / WEEK		
FILTRATE	L	1200			jr 1.0185	2.12										
SUMP	L															
	L	1700			1.017	1.61	120	993	3.8	101						
	X	800			1.011	<.002	46.5	1020	0.4	40.9	0.5	6428	7.9	1 / WEEK		
THICKENER	L	1200			1.011	.008										
OVERFLOW	X															
	L	1700			1.012	.009										
	X	800			1.049	8.10	471	969	20.6	431	0.4	4847	6.4	1 / WEEK		
THICKENER	L	1200			1.024	3.37										
UNDERFLOW	X															
	L	1c			1.021	2.59										

DATE 8/24/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	700	5.86	55.4	meter 1.185 / 1.177	26.6	1695	1207	34.4	1667	0.5	6822	7.3	1 / WEEK		
BLEED	L	1200	5.9	56	1.174	22.4	1769	1037	31.3 ANALYZ	1752		7103				
PUMP	X	~~1600~~							~~27.9~~ ANALYZ							
	L	1600	6.1		1.177	26.8	1750	1310	27.9 ANALYZ	1700		7274				
GYPSUM	X	700	8.66				23.5%	.16%	.63%	55.9%		13.2	423	1 / WEEK	7.75	20.16
PRODUCT	L	1600					23.0%	.15%	.73%	54.6%		15.0			5.70	20.16
	X	700			1.020	2.03	163	971	8.0	143	<0.3	4869	7.7	1 / WEEK		
FILTRATE	L	1200			1.0175	1.98										
SUMP	L	~~1600~~														
	L	1600			1.020	2.01	154	1035	7.0	134						
	X	700			1.010	.023	45.7	976	1.7	39.6	<0.3	4863	6.8	1 / WEEK		
THICKENER	L	1200			1.0095	.025										
OVERFLOW	X	~~1600~~														
	L	1600			1.011	<.002										
	X	700			1.026	4.32	252	918		223	<0.3	4329	6.4	1 / WEEK		
THICKENER	L	1200			1.026											
UNDERFLOW	X	~~1600~~														
		600			1.033	5.27										

DATE 8/23/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
			X	X	X	X			X		X	X				
ABSORBER	X	1800	5.90	53.9	meter 1.175 1.171	23.8	1644	1184	31.4	1614	<0.3	8114	7.6	1 / WEEK		
BLEED	L	1600	5.84	54.6	meter 1.178 1.174	24.6	1741	1531	29.6 ANALYZ	1713		7430				
PUMP	X	~~2000~~							ANALYZ							
	L	2200			1.170	26.5	1718	1409	30.0 ANALYZ	1691		7391				
GYPSUM	X	1800	8.58				23.0%	.10%	1.01%	54.0%		15.9	414	1 / WEEK	5.79	19.80
PRODUCT	L	2000					22.4%	.15%	1.20%	52.5		25.9			3.29	20.27
FILTRATE	X	1800			1.015	0.51	118	946	8.15	89.3	<0.3	5123	6.8	1 / WEEK		
	L	1600			1.0130	0.96										
SUMP	L	~~2000~~														
	L	2200			1.0165	1.29	112	893	8.4	86.0						
THICKENER	X	1800			1.010	.003	49.5	953	0.59	40.6	<0.3	5416	7.6	1 / WEEK		
	L	1600			1.0095	.021										
OVERFLOW	X	~~2000~~														
	L	2200			1.012	.028										
THICKENER	X	1800			1.058	8.75	564	925	19.4	540	<0.3	4870	6.0	1 / WEEK		
	L	1600			1.014	2.46										
UNDERFLOW	X	~~2000~~														
		2200			1.022	5.63										

Absorber 0800 A0822208 pH 5.88 Temp 52.C Density 1.168 Density meter 1.177 CO3

			X	X	X	X			X		X	X				
DATE 8/22/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1200 ~~800~~	5.9	53	1.182 1.185	25.2	1785	1500	49.25 ANALY	1742	<0.3	8145	7.6	1 / WEEK		
BLEED	L	1600 ~~1000~~	6.02	54	meter 1.177 1.172	23.9	1722	1200	47.5 ANALYZ	1676		8313				
PUMP	X	~~2000~~							~~48~~ ANALYZ							
	L	2200			meter 1.175 1.162	24.0	1609	1400	48.0 ANALYZ	1569		7698				
GYPSUM	X	1200 ~~800~~	8.27				23.0%	.21%	1.17%	54.0%		30.5	503	1 / WEEK	7.19	20.00
PRODUCT	L	2000					23.2%	.15%	0.95%	54.3%		11.6			6.05	19.71
	X	1200 ~~800~~			1.018	2.00	163	1000	14.6	135	<0.3	4873	6.6	1 / WEEK		
FILTRATE	L	1600 ~~1400~~			1.019	2.36										
SUMP	L	~~2000~~														
	L	2200			1.026	2.77	192	1107	15.0	165						
	X	1200 ~~800~~			1.010	0.0021	49.5	1000	0.42	43.6	<0.3	5672	7.6	1 / WEEK		
THICKENER	L	1600 ~~1400~~			1.011	.0148										
OVERFLOW	X	~~2000~~														
	L	2200			1.0135	.013										
	X	1200 ~~800~~			1.023	2.83	196	1300	18.5	166	<0.3	4956	6.3	1 / WEEK		
THICKENER	L	1600 ~~1400~~			1.042	6.39										
UNDERFLOW	X	~~2000~~														
		2200			1.061	9.66										

DATE 8/21/92		PH	TEMP C	DENSITY g/L	DENSITY METER	SOLIDS wt %	Ca mmol/L	CO3 mmol/L	SO3 mmol/L	S mmol/L	Cl ppm
ABSORBER	7:00 AM	5.6	53	1.154	1.170	21.9	1588	43.2	<0.3	1561	8895
FILTRATE SUMP	7:00 AM	6.7	25	1.0215		1.93					
THICKENER U/F	7:00 AM	6.7	26	1.049		7.05	473	60.0		394	
THICKENER O/F	7:00 AM	6.7	25	1.0120		.009	50.5	0.6		45.2	5689
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	7:00 AM	8.52	8.78	20.00	23.1%	0.99	53.9	21.8			

DAILYRPT.XLS

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
8/20/92			C	g/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	7:00 AM	6.2	53	1.167	1.165	23.5	1594	42.5	<0.3	1554	9827
FILTRATE SUMP	7:00 AM	6.8	30	1.0190		1.64					
THICKENER U/F	7:00 AM	6.8	30	1.224		32.4	2244	28.9		2215	
THICKENER O/F	7:00 AM	6.8	30	1.0125		.155	62.6	2.1		48.9	6490
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	7:00 AM	8.29	5.99	20.12	23.1	1.11	53.7	19.8			

DAILYRPT.XLS

DATE		PH	TEMP C	DENSITY g/L	DENSITY METER	SOLIDS wt %	Ca mmol/L	CO3 mmol/L	SO3 mmol/L	S mmol/L	Cl ppm
8/19/92											
ABSORBER	7:00 AM	5.7	55	1.182	1.202	25.8	1836	88.8	<0.3	1717	8663
FILTRATE SUMP	7:00 AM	5.6		1.064 26°C		9.06					
THICKENER U/F	7:00 AM	~~6.2~~		~~1.574 31°C~~		~~63.2~~	~~5733~~	~~112~~		~~3306~~	
THICKENER O/F	7:00 AM	5.8		1.0145 29°C		.229	75.4	7.3		54.2	7392
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	7:00 AM	8.59	6.56	20.06	23.1%	1.21%	53.6%	71			

W0819210
TSS - 11.6 ppm

G0818220
sampled from pile
Cl – 67 ppm

DATE 8/18/92		TIME	PH	TEMP C	DENSITY mg/L	SOLIDS wt %	Ca mmol/L	Mg ppm	CO3 mmol/L	SO4 mmol/L	SO3 2- mmol/L	Cl ppm	F- ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
			X	X	X	X			X		X	X				
ABSORBER	X	800	B 5.65 5.6	55	meter 1.182 / 1.173	24.2	1719	1388	26.1	1694	1.35	10490	8.8	1 / WEEK		
BLEED	L	1400 ~~1400~~	B-5.63 5.6	55	Meter 1.206 / 1.195	26.2	1960	1388	35.6 ANALYZ	1927		11118				
PUMP	X	1900 ~~1830~~ ~~2000~~	B 5.63						35.0 ANALYZ							
	L	2200			1.185	25.4	1793	1589	ANALYZ	1772		9638				
GYPSUM	X	800	8.36				23.2%	.11%	1.02%	54.8%		148	459	1 / WEEK	8.18	20.00
PRODUCT	L	2200					22.9%	.10%	0.77%	53.7%		111			6.50	20.22
	X	800			1.0195	1.42	134	1144	17.1	105	0.4	7364	8.6	1 / WEEK		
FILTRATE	L	1400			1.0200	1.52										
SUMP	L	1900 ~~2000~~														
	L	2200			1.0195	0.92	113	1396	8.1	78						
	X	800			1.0125	.006	55.2	1252	0.43	47.1	0.05	6984	8.9	1 / WEEK		
THICKENER	L	1400			1.0125	.004										
OVERFLOW	X	1900 ~~2000~~														
	L	2200			1.0150	.005										
	X	800			1.069	10.4	710	1768	158	466		6476	7.2	1 / WEEK		
THICKENER	L	1400			1.041	5.51										
UNDERFLOW	X	1900 ~~2000~~														
		2200			1.042	5.58										

A07 Solids - [illegible]
Density - 1.187
CO3 - 71.8
} A0817207

DATE 8/17/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	1100	5.6	55	meter 1.198 / 1.194	25.2	1866	1218	74.5	1762	1.9	10316	8.5	1 / WEEK		
BLEED	L								ANALYZ							
PUMP	X								ANALYZ							
	L	1700	5.7	55	meter 1.177 lab 1.174	23.8	1715	1503	73.8 ANALYZ	1626		9825				
GYPSUM	X	700	8.49				23.3%	.10%	1.35%	53.3%		18.5	583	1 / WEEK	6.50	19.8
PRODUCT	L	1700					23.3%	.16%	1.35%	54.1%		118			5.77	
FILTRATE	X	1100			1.0235	2.52	2.19	1181	12.7	173	0.7	6980	7.5	1 / WEEK		
	L															
SUMP	L															
	L	1700			1.0235	2.30	213	1322	14.2	181						
THICKENER	X	1100			1.0110	.026	55.3	1140	1.48	45.1	0.2	6486	8.1	1 / WEEK		
	L	1700			1.014	.160										
OVERFLOW	X															
	L															
THICKENER	X	1100			1.099	15.0	1012	1371	97.7	862	3.3	6322	6.6	1 / WEEK		
	L	1700			1.146	21.6										
UNDERFLOW	X															
	L															

DAILYRPT.XLS

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
8/16/92			C	g/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	7:00 AM	5.8	54	1.159	1.144	23.8	1693	59.3	<0.3	1636	10771
FILTRATE SUMP	7:00 AM	5.8	33	1.0215		2.34					
THICKENER U/F	F 7:00 AM	5.7	32	1.099		15.5	1097	155.0		823	
THICKENER O/F	7:00 AM	6.1	33	1.0125		.021	63.2	1.13		51.0	7887
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	7:00 AM	8.32	7.02	19.83	23.1%	1.64	53.0	56.5			

in oven
@ 230°C

DAILYRPT.XLS

DATE 8/15/92		PH (in lab)	TEMP (plant) C	DENSITY g/L	DENSITY METER	SOLIDS wt %	Ca mmol/L	CO3 mmol/L	SO3 mmol/L	S mmol/L	Cl ppm
ABSORBER	7:00 AM	6.46	5.7 (pH) / 55.0	1.147 @ 25.1°C	1.139	20.4	1316	56.0	<0.3	1236	11046
FILTRATE SUMP	7:00 AM	6.80		1.017 @ 25.1°C		2.82					
THICKENER U/F	7:00 AM	6.84		1.105 @ 24.8°C		16.7	1163	161		879.9	
THICKENER O/F	7:00 AM	6.78		1.008 @ 24.8°C		0.012	61.7	1.40		50.9	8429
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	7:00 AM	8.40	7.13	19.86	23.1	1.55	53.2	72.9			

DATE		PH	TEMP	DENSITY	DENSITY	SOLIDS	Ca	CO3	SO3	S	Cl
8/14/92			C	mg/L	METER	wt %	mmol/L	mmol/L	mmol/L	mmol/L	ppm
ABSORBER	7:00 AM	5.7	55	1.153	1.167	21.5	1491	58.6	0.3	1384	11164
FILTRATE SUMP	7:00 AM	6.7	27	1.0260		2.75					
THICKENER U/F	7:00 AM	6.8	30	1.154		21.8	1515	109.5		1358	
THICKENER O/F	7:00 AM	6.8	30	1.0145		.011	65.0	0.8		51.4	7915
		pH	FREE WATER wt %	COMBINED WATER wt %	Ca wt %	CO3 wt %	SO4 wt %	Cl ppm			
GYPSUM	7:00 AM	8.30	7.61	19.91	23.1%	1.85	52.1%	18.3			

DATE 8/13/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	Mg ppm	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F- ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	700	5.5	55	meter-1.134 1.158	20.5	1521	1521	41.5	1454	< 0.3	10492	9.65	1 / WEEK		
BLEED	L	1300	Plant 5.7		1.160	21.5	1584	2657	58.3 ANALYZ	1510		10992				
PUMP	X															
	L	1900	Plant 5.7		1.158	22.4	1590	1316	65.0 ANALYZ	1524		11731				
GYPSUM	X	700	8.40				23.3%	.10%	1.33%	53.9%		32.1	322	1 / WEEK	7.31	19.62
PRODUCT	L	1500 ~~1900~~					23.2%	.16%	1.50%	53.3%		18.7			7.34	19.77
	X	700			1.0250	2.68	223	1100	14.7	176	<0.3	7299	8.41	1 / WEEK		$\boxed{19.81}$
FILTRATE	L	1300			1.025	2.51										
SUMP	L															
	L	1900			1.0220	2.53	221	951	16.1	173						
	X	700			1.0150	.030	174	1255	0.9	49.0	< 0.3	10522	9.13	1 / WEEK		
THICKENER	L	1300			1.015	.012										
OVERFLOW	X	1900			1.012	.749										
	L															
	X	700			1.087	12.8	818	1901	156	556	< 0.3	7298	7.35	1 / WEEK		
THICKENER	L	1300				13.3										
UNDERFLOW	X	1900				20.9										

DATE 8/12/92		TIME	PH (X)	TEMP C (X)	DENSITY mg/L (X)	SOLIDS wt % (X)	Ca mmol/L	Mg ~~mmol/L~~ ppm	CO3 mmol/L (X)	SO4 mmol/L	SO3 2- mmol/L (X)	Cl ppm (X)	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	700 ~~800~~	5.6	55	meter-1.168 lab 1.153	20.7	1385	2005	40.7	1333	<0.3	12042	10.6	1 / WEEK		
BLEED	L	1300 ~~1400~~	5.7	55	meter-1.164 lab 1.143	20.6	1409	1678	57.5 ANALYZ	1348		12812				
PUMP	X	~~2000~~							~~ANALYZ~~							
	L	1900 ~~200~~	5.58	55	meter - 1.148 ~~1.149~~	22.2	1443	1165	38.1 ANALYZ	1379		13104				
GYPSUM	X	700 ~~800~~	8.59				23.1%	.21%	1.45%	53.1%		52	378	1 / WEEK	6.33	19.80
PRODUCT	L	1900 ~~2000~~					22.5%	.31%	1.21%	52.6%		16.9			6.85	19.80
	X	700 ~~800~~			1.0270	2.70	222	913	13.2	165	<0.3	9029	8.5	1 / WEEK		
FILTRATE	L	1300 ~~1400~~			1.0260	2.48										
SUMP	L	~~2000~~														
	L	1900 ~~200~~			1,024	3.15	220	1362	18.9	174						
	X	700 ~~800~~			1.0145	.042	65.3	1375	1.3	50.0	<0.3	8783	9.5	1 / WEEK		
THICKENER	L	1300 ~~1400~~			1.0150	.054										
OVERFLOW	X	1900 ~~2000~~			1,010	.009										
	L	~~200~~														
	X	700 ~~800~~			1.120	18.1	1136	1079	84.5	1004	<0.3	7226	7.2	1 / WEEK		
THICKENER	L	1300 ~~1400~~			1.129	19.5										
UNDERFLOW	X	1900 ~~2000~~			1.068	9.55										
		~~200~~														

DATE 8/11/92		TIME	X PH	X TEMP C	X DENSITY mg/L	X SOLIDS wt %	Ca mmol/L	ppm Mg ~~mmol/L~~	X CO3 mmol/L	SO4 mmol/L	X SO3 2- mmol/L	X Cl ppm	F - ppm	Al, Mn, Si, Fe Na, K (ppm)	MOISTURE wt. %	COM. H2O wt. %
ABSORBER	X	700 ~~800~~	5.8	56	1.135	19.0	1266	1556	61.1	1178	1.9	10410	11.2	1 / WEEK		
BLEED	L	1300 ~~1400~~	5.85		1.132	18.8	1294	1437	42.3 ANALYZ	1224		11242				
PUMP	X	~~2000~~							~~ANALYZ~~							
	L	1900 ~~200~~	5.77		1.140	19.7	1489	1167	46.1 ANALYZ	1424		12140				
GYPSUM	X	700 ~~800~~	8.47				23.5%	.44%	1.89 %	53.3%		60.1		1 / WEEK	10.3	19.64
PRODUCT	L	1900 ~~2000~~					23.0%	.21%	1.33%	53.7 %		10.8	478		7.88	19.69
	X	700 ~~800~~			1.022	2.11	169	1342	13.8	131		8886	8.3	1 / WEEK		
FILTRATE	L	1300 ~~1400~~			1.021	2.27										
SUMP	L	~~1805~~ ~~2000~~														
	L	1900 ~~200~~			1.025	2.38	199	1345	14.7	161						
	X	700 ~~800~~			1.0145	.116	73.3	1312	3.56	48		7801	8.7	1 / WEEK		
THICKENER	L	1300 ~~1400~~			1.011	.022										
OVERFLOW	X	1900 ~~2000~~			1.0145	.013										
	L	~~200~~														
	X	700 ~~800~~			1.101	14.6	1312	2267	153.3	719		8073	6.8	1 / WEEK		
THICKENER	L	1300 ~~1400~~			1.083	12.3										
UNDERFLOW	X	1900 ~~2000~~			1.091	13.6										
		~~200~~														

The following section details some of the calculation methods used in the test program. Sample calculations are shown for clarity.

SECTION 6.7 CALCULATION METHODS

PURE AIR
CAE Project No : 6331

SAMPLE CALCULATIONS - RUN 1, UNITS 7 and 8 COMBINED FGD INLET

(Note : results are taken from computer analysis)

1. Volume of water collected

$$V_{wstd} = (0.04707\ ft^3/ml)\ (V_{lc})$$
$$= (0.04707)\ (171)$$
$$= 8.05\ wscf$$

2. Volume of gas metered, standard conditions

$$V_{mstd} = \frac{(17.64\ ^\circ R/in.\ Hg)\ (V_m)\left[P_b + \frac{DH}{13.6}\right]}{(460 + T_m)}(Y_d)$$
$$= \frac{(17.64)\ (72.68)\ \left[29.31 + \frac{1.03}{13.6}\right]}{(460 + 120)}(0.9946)$$
$$= 64.64\ dscf$$

3. Moisture content

$$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$$
$$= \frac{8.05}{64.64 + 8.05}$$
$$= 0.1107$$
$$= 11.1\ \%$$

Saturated Moisture - Run 2, New Stack

$$B_{wo} = \frac{V_p\ @\ T_s}{P_s}$$
$$= \frac{4.287}{29.17}$$
$$= 0.1470$$
$$= 14.7\ \%$$

4. Molecular weight of dry gas stream

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%CO + \%N_2)$$
$$= 0.44(12.8) + 0.32(6.2) + 0.28(81.0)$$
$$= 30.30$$

5. Molecular weight of stack gas

$$M_s = M_d\ (1 - B_{wo}) + 18(B_{wo})$$
$$= 30.30\ (1 - 0.1107) + 18(0.1107)$$
$$= 28.93$$

6. Stack pressure (in. Hg)

$$P_s = P_b + \left(\frac{STATIC\ P}{13.6}\right)$$
$$= 29.31 + \left(\frac{6.8}{13.6}\right)$$
$$= 29.81$$

SAMPLE CALCULATIONS (Continued)

7. Velocity of stack gas

$$V_s = K_p \, C_p \, \overline{(DP)^{\frac{1}{2}}} \frac{[T_s + 460]^{\frac{1}{2}}}{[(M_s)(P_s)]^{\frac{1}{2}}}$$

$$= 85.49\,(0.84)\,(1.076)\,\frac{[321 + 460]^{\frac{1}{2}}}{[(28.93)\,(29.81)]^{\frac{1}{2}}}$$

$$= 73.5 \text{ ft/sec}$$

8. Total flow of stack gas

$$Q_s = (60)\,(A_s)\,(V_s)$$
$$= (60)\,(459)\,(73.5)$$
$$= 2,024,000 \text{ acfm}$$

$$Q_{std} = \frac{Q_s \, P_s \, (17.64\,^{\circ}R/\text{in. Hg})\,(1 - B_{wo})}{T_s + 460}$$

$$= \frac{(2,024,000)\,(29.81)\,(17.64)\,(1 - 0.1107)}{321 + 460}$$

$$= 1,212,000 \text{ dscfm}$$

9. Percent isokinetic

$$\%I = \frac{(0.09450)\,(T_s + 460)\,V_{mstd}}{P_s \, V_s \, A_n \, \Theta \, (1 - B_{wo})}$$

$$= \frac{(0.09450)\,(321 + 460)\,(64.64)}{(29.81)\,(73.5)\,(0.000195)\,(126)\,(1 - 0.1107)}$$

$$= 99.7\,\%$$

10. Nonsulfuric acid particulate - Method 5B

$$\text{gr/dscf} = \frac{(15.43 \text{ gr/g})\,(M_n)}{V_{mstd}}$$

$$= \frac{(15.43)\,(0.1603)}{64.64}$$

$$= 0.0383$$

$$\text{lb/hr} = \frac{(\text{gr/dscf})\,(Q_{std})\,(60)}{7,000 \text{ gr/lb}}$$

$$= \frac{(0.0383)\,(1,212,000)\,(60)}{7,000}$$

$$= 398$$

SAMPLE CALCULATIONS (Continued)

10. Nonsulfuric acid particulate - Method 5B (continued)

$$\begin{aligned} lb/MBtu &= \frac{(gr/dscf)\,(F_d)\,(20.9)}{(7,000\ gr/lb)\,(20.9 - \%O_2)} \\ &= \frac{(0.0383)\,(9,780)\,(20.9)}{(7,000)\,(20.9 - 6.2)} \\ &= 0.0760 \end{aligned}$$

11. Particulate removal efficiency

$$\begin{aligned} \% &= \frac{lb/MBtu_{inlet} - lb/MBtu_{outlet}}{lb/MBtu_{inlet}}(100) \\ &= \frac{0.0760 - 0.0131}{0.0760}(100) \\ &= 82.8 \end{aligned}$$

12. Sulfur dioxide - Method 6C

$$\begin{aligned} ppm_{drift\ calibrated} &= \left(C_{avg} - C_o\right)\frac{C_{ma}}{(C_m - C_o)} \\ &= (2,036 - 1.25)\frac{1,812.5}{(1,904 - 1.25)} \\ &= 2,138 \end{aligned}$$

C_{avg} = Average gas concentration indicated by gas analyzer, dry basis, ppm.
C_o = Average of initial and final system calibration bias check responses for the zero gas, ppm.
C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm.
C_{ma} = Actual concentration of the upscale calibration gas, ppm.

$$\begin{aligned} lb/hr &= \left(\frac{\left(ppm_{drift\ calibrated}\right)(MW)}{385.3 \times 10^6\ ft^3/lb\ mole}\right)(dscfm)(60) \\ &= \left(\frac{(2,138)\ (64.06)}{385.3 \times 10^6}\right)(1,261,000)(60) \\ &= 26,900 \end{aligned}$$

PURE AIR
CAE Project No: 6331

SAMPLE CALCULATIONS (Continued)

12. Sulfur dioxide (Continued)

$$
\begin{aligned}
\text{lb/MBtu} &= \frac{(\text{lb/dscf})\,(F_d)\,(20.9)}{(20.9 - \%O_2)} \\
&= \frac{(3.56 \times 10^{-4})\,(9,780)\,(20.9)}{(20.9 - 6.2)} \\
&= 4.944
\end{aligned}
$$

The calculations for nitrogen oxides are performed in a similar manner. The molecular weight of nitrogen oxide is 46.

13. Sulfur dioxide removal efficiency

$$
\begin{aligned}
\% &= \frac{(\text{lb/MBtu}_{inlet} - \text{lb/MBtu}_{outlet})}{\text{lb/MBtu}_{inlet}}(100) \\
&= \frac{(4.944 - 0.418)}{4.944}(100) \\
&= 91.5
\end{aligned}
$$

The calculation for nitrogen oxides removal efficiency is performed in a similar manner.

14. *Sulfur dioxide - Method 8 - Run 3, Units 7 and 8 Combined FGD Inlet*

$$
\begin{aligned}
\text{lb/dscf} &= \frac{(V_t - V_{tb})\,(N)\,(\frac{V_{soln}}{V_a})\,(K_2)}{(V_{mstd})} \\
&= \frac{(20.65 - 0.1)\,(0.0104)\,(\frac{1000}{1})(7.061 \times 10^{-5}\ \text{lb/meq})}{(40.13)} \\
&= 3.78 \times 10^{-4}
\end{aligned}
$$

$$
\begin{aligned}
\text{ppm} &= (\text{lb/dscf})\,(\frac{385.3 \times 10^6 \text{ft}^3/\text{lb mole}}{64\ \text{lb/lb mole}}) \\
&= (3.78 \times 10^{-4})(6.015 \times 10^6) \\
&= 2,277
\end{aligned}
$$

$$
\begin{aligned}
\text{lb/hr} &= (\text{lb/dscf})\,(\text{dscfm})\,(60) \\
&= (3.78 \times 10^{-4})\,(1,730,000)\,(60) \\
&= 39,290
\end{aligned}
$$

SAMPLE CALCULATIONS (Continued)

14. Sulfur dioxide - Method 8 (continued)

$$\text{lb/MBtu} = \frac{(\text{lb/dscf})\,(F_d)\,(20.9)}{(20.9 - \%O_2)}$$
$$= \frac{(3.78 \times 10^{-4})\,(9{,}780)\,(20.9)}{(20.9 - 6.2)}$$
$$= 5.263$$

The calculations for sulfuric acid mist are performed in a similar manner. The values for K_2 and the constant in the ppm calculation are 1.081×10^{-4} and 3.929×10^{6}, respectively.

15. Hydrogen chloride concentration - Run 3 - Units 7 and 8 Combined FGD Inlet

$$mg_{Cl} = \frac{(V_t - V_{tb})\,(N)\,(V_{soln})\,(35{,}450)}{(V_a)\,(1{,}000)}$$
$$= \frac{(19.75 - 0.2)\,(0.01414)\,(360)\,(35{,}450)}{(50)\,(1{,}000)}$$
$$= 70.6$$

$$mg_{HCl} = \frac{(MW_{HCl})}{MW_{Cl}}(mg_{Cl})$$
$$= \frac{(36.46)}{(35.45)}(70.6)$$
$$= 72.6$$

$$\text{lb/dscf} = \frac{(mg_{HCl})}{(453{,}590\ \tfrac{mg}{lb})\,(V_{mstd})}$$
$$= \frac{(72.6)}{(453{,}590)\,(69.40)}$$
$$= 2.31 \times 10^{-6}$$

$$\text{mg/dscm} = \frac{(mg_{HCl})}{(0.028317)\,(V_{mstd})}$$
$$= \frac{72.6}{(0.028317)\,(69.40)}$$
$$= 36.9$$

$$\text{lb/hr} = (\text{lb/dscf})\,(\text{dscfm})\,(60)$$
$$= (2.31 \times 10^{-6})\,(1{,}274{,}000)\,(60)$$
$$= 176$$

SAMPLE CALCULATIONS (Continued)

15. Hydrogen chloride concentration (continued)

$$\text{ppm} = (\text{lb/dscf})\frac{(385.3\text{x}10^6\ \text{ft}^3/\text{lb mole})}{(\text{molecular weight})}$$

$$= (2.31 \times 10^{-6})\frac{(385.3\text{x}10^6)}{(36.46)}$$

$$= 24$$

$$\text{lb/MBtu} = \frac{(\text{lb/dscf})\ (F_d)\ (20.9)}{(20.9 - \%O_2)}$$

$$= \frac{(2.31 \times 10^{-6})\ (9,780)\ (20.9)}{(20.9 - 6.2)}$$

$$= 0.0321$$

Hydrogen fluoride is calculated in a similar manner. The molecular wieght ratio of fluoride is $\left(\frac{20.01}{19.00}\right)$.

SECTION 6.8 DATA COLLECTION SYSTEM

6.8 DATA COLLECTION SYSTEM

The Bailly AFGD System is controlled by a DCS (Distributed Control System) where all important plant control variables are displayed on a video screen. Actions to control the plant are taken via the operator on a keyboard. While the DCS system obtains data from the plant and can store it, the basic system is designed for plant production reports and not scientific applications. The plant DCS system was supplemented by a PC-based monitoring program which runs in the DOS environment and saves plant data to a hard disk drive. The PC system is dedicated 100% of the time to the collection of important plant variables. A scan of the plant is taken every 5 minutes and recorded to disk. The 5 minute values are averaged for the hour, resulting in a 24-hour period with 24 one-hour data points. The hours of the test are determined and the appropriate data points are held while the hours not included are removed from the composite file. The average values for the test period are then determined by averaging the included hours.

The laboratory results are entered into the plant PC, where a database is maintained for the laboratory analysis. Other external analysis sources are also coded and entered into the PC database. These include coal analysis, wastewater analysis, CEM data (Continuous Emissions Monitoring) system and others.

Both Units 7 & 8 are treated Date	Unit #7 Air Flow (pph)	Unit #8 Air Flow (pph)	Unit #7 Load (MW)	Unit #8 Load (MW)	AI-110A Unit #7 Opacity (%)
11-Aug-92	1070	3029	175	339	19
12-Aug-92	1041	2835	171	321	18
13-Aug-92	1054	3098	175	346	12
17-Aug-92	1011	3023	170	348	16
18-Aug-92	1042	3081	175	348	15
27-Aug-92	1058	3012	175	341	15
28-Aug-92	1059	2991	178	340	16
1-Sep-92	955	2943	158	343	14
2-Sep-92	1011	2987	166	344	14
3-Sep-92	1034	3024	172	348	15
4-Sep-92	1020	2975	171	346	15
21-Sep-92	1064	2738	175	308	14
22-Sep-92	1065	2989	175	344	15
22-Sep-92	818	2420	132	274	13
23-Sep-92	692	2402	112	277	12
24-Sep-92	833	2868	135	341	13
25-Sep-92	1048	2911	175	341	15
29-Sep-92	1029	2688	171	323	15

Both Units 7 & 8 are treated Date	AI-110B Unit #8 Opacity (%)	PT-105A Unit #7 nlet Pres (iwc)	PT-105B Unit #8 nlet Pres (iwc)	PT-117 M/E Inlet Pressure (iwc)	PT118 M/E Outlet Pressure (iwc)
11-Aug-92	26	9.0	8.9	3.2	1.1
12-Aug-92	10	7.9	7.7	2.9	0.8
13-Aug-92	7	8.3	8.1	3.0	0.8
17-Aug-92	13	8.6	8.5	3.2	1.6
18-Aug-92	19	8.7	8.5	3.2	1.5
27-Aug-92	10	8.4	8.2	3.0	0.8
28-Aug-92	10	7.9	7.6	2.6	0.5
1-Sep-92	9	7.3	7.1	3.4	0.9
2-Sep-92	13	7.8	7.6	4.0	0.6
3-Sep-92	17	9.3	9.1	3.3	1.1
4-Sep-92	13	7.7	7.5	3.1	0.9
21-Sep-92	11	7.9	7.7	2.9	0.8
22-Sep-92	17	9.1	8.8	2.7	0.5
22-Sep-92	11	5.6	5.5	1.5	0.0
23-Sep-92	16	4.8	4.9	1.5	0.1
24-Sep-92	26	7.1	7.0	2.4	0.5
25-Sep-92	11	8.5	8.3	3.0	0.9
29-Sep-92	6	7.8	7.6	2.8	0.7

Both Units 7 & 8 are treated Date	TI-209 WES Inlet Temp (F)	TR-111 Absorber Inlet Temp (F)	AIT-109 Absorber Inlet SO2 (ppm)	FR-112 Absorber Inlet F.G. (kscfm)	SIC-425A Limestone Feed Rate (tph)
11-Aug-92	394	347	2141	855	0.0
12-Aug-92	390	337	2251	774	6.9
13-Aug-92	392	344	2308	816	15.0
17-Aug-92	392	344	2427	786	15.2
18-Aug-92	391	345	2340	831	0.0
27-Aug-92	385	319	2295	22	13.2
28-Aug-92	386	320	2277	10	5.5
1-Sep-92	388	321	2311	1136	0.0
2-Sep-92	388	322	2203	1150	14.6
3-Sep-92	389	323	2278	1221	9.6
4-Sep-92	391	323	2313	1191	0.0
21-Sep-92	398	327	2161	1306	0.0
22-Sep-92	403	335	2216	1466	0.0
22-Sep-92	401	323	2144	1155	0.0
23-Sep-92	399	322	2144	1102	10.8
24-Sep-92	402	328	2209	1331	11.8
25-Sep-92	401	330	2187	1409	6.9
29-Sep-92	405	324	2202	1322	3.2

Both Units 7 & 8 are treated Date	SIC-425B Limestone Feed Rate (tph)	SIC-3399 Lime Feed Rate (tph)	AR-126 Absorber Outlet SO2 (ppm)	FIC-127 Absorber Makeup H2O (gpm)	LI-129-01 Absorber Level (ft)
11-Aug-92	10.7	0.0	111.1	422.4	20.7
12-Aug-92	9.7	0.0	132.4	294.6	19.7
13-Aug-92	0.3	0.0	120.6	359.4	19.2
17-Aug-92	0.3	0.0	91.1	366.7	20.5
18-Aug-92	13.6	0.0	220.6	365.3	20.0
27-Aug-92	2.2	0.0	149.5	272.8	20.3
28-Aug-92	5.6	0.0	136.0	249.8	19.9
1-Sep-92	14.7	0.0	143.6	511.6	19.9
2-Sep-92	0.3	0.0	208.1	462.1	20.1
3-Sep-92	4.5	0.0	150.8	216.1	20.6
4-Sep-92	12.5	0.3	247.7	231.0	20.6
21-Sep-92	16.7	0.0	155.6	362.7	19.6
22-Sep-92	15.8	0.0	120.2	426.5	20.6
22-Sep-92	12.7	0.0	72.7	373.4	20.6
23-Sep-92	0.3	0.0	78.0	301.0	20.9
24-Sep-92	0.3	0.0	122.3	346.2	20.7
25-Sep-92	8.2	0.0	180.8	347.5	20.5
29-Sep-92	14.2	0.0	173.7	371.7	20.2

Both Units 7 & 8 are treated Date	LI-129-02 Absorber Level (ft)	LI-146 Centrifuge Fd Tk (%)	AIC-134 Absorber Density (gm/ml)	AIC-138A Absorber pH (-)	AIC-138B Absorber pH (-)
11-Aug-92	20.7	61.6	1.14	5.82	5.71
12-Aug-92	19.7	60.4	1.15	5.75	5.73
13-Aug-92	19.3	59.6	1.14	5.76	5.62
17-Aug-92	20.5	57.6	1.18	5.81	5.79
18-Aug-92	20.0	61.4	1.20	5.66	5.62
27-Aug-92	20.3	60.0	1.19	6.23	6.04
28-Aug-92	19.9	60.9	1.18	6.13	6.04
1-Sep-92	19.9	61.0	1.19	6.08	6.00
2-Sep-92	20.1	61.1	1.18	6.11	6.03
3-Sep-92	20.6	59.7	1.19	6.10	6.03
4-Sep-92	20.6	59.1	1.17	6.12	6.07
21-Sep-92	19.6	61.2	1.18	6.34	6.43
22-Sep-92	20.7	60.7	1.18	5.81	5.73
22-Sep-92	20.6	60.9	1.18	5.87	5.78
23-Sep-92	20.9	61.7	1.18	5.96	5.86
24-Sep-92	20.7	61.0	1.19	5.87	5.78
25-Sep-92	20.6	62.0	1.18	5.79	5.67
29-Sep-92	20.3	60.9	1.18	5.87	5.76

Both Units 7 & 8 are treated Date	AIC-136 Absorber SO3 (mmol/l)	AIT-135 Absorber CO3 (mmol/l)	PI-147A "A" Header Pressur (psig)	PI-147B "B" Header Pressur (psig)	LI-194 Filtrate Sump lvl (%)
11-Aug-92	0.54	44.3	17.0	18.9	46
12-Aug-92	0.37	47.3	17.0	18.8	49
13-Aug-92	0.76	61.7	17.1	18.9	48
17-Aug-92	1.17	73.5	17.6	19.4	52
18-Aug-92	0.62	34.7	17.6	19.5	21
27-Aug-92	0.62	113.3	17.5	19.4	46
28-Aug-92	0.98	131.2	17.4	19.3	46
1-Sep-92	1.29	74.7	16.2	18.2	47
2-Sep-92	0.85	75.9	16.2	19.3	50
3-Sep-92	0.78	77.6	19.0	19.6	51
4-Sep-92	0.84	78.7	16.2	18.1	50
21-Sep-92	0.62	75.3	17.3	19.1	49
22-Sep-92	0.89	78.0	18.7	20.3	49
22-Sep-92	0.87	79.2	18.6	20.2	51
23-Sep-92	0.71	127.7	17.5	19.0	57
24-Sep-92	0.71	126.3	17.6	19.2	49
25-Sep-92	1.09	77.8	17.5	19.1	41
29-Sep-92	1.17	73.9	17.4	19.0	49

Both Units 7 & 8 are treated Date	AIT-190A Filtrate Sump pH (-)	AIT-190B Filtrate Sump pH (-)	FI-212 WES Water Flow Rate (gpm)	LI-220 Thickener O/F Tk Lvl (%)	AIT-221 Waste Wtr Chloride (ppm)
11-Aug-92	6.7	6.8	0.4	20.0	5534
12-Aug-92	6.7	6.8	0.4	20.0	5539
13-Aug-92	6.8	6.8	0.3	20.0	5540
17-Aug-92	7.0	6.8	0.4	20.0	5538
18-Aug-92	6.9	6.9	0.4	20.0	5539
27-Aug-92	7.0	7.1	0.3	20.0	5538
28-Aug-92	7.0	7.1	0.3	20.0	5539
1-Sep-92	7.1	7.1	0.4	20.0	0
2-Sep-92	7.1	7.7	0.4	20.0	-4
3-Sep-92	7.0	7.4	0.4	20.0	-12
4-Sep-92	7.0	7.2	0.4	20.0	572
21-Sep-92	7.6	6.8	1.5	20.0	4630
22-Sep-92	4.3	6.5	1.1	20.0	5065
22-Sep-92	4.3	6.5	0.6	20.0	5216
23-Sep-92	5.8	6.6	3.4	20.0	5281
24-Sep-92	8.4	6.5	4.4	20.0	2380
25-Sep-92	8.7	6.5	2.4	20.0	4496
29-Sep-92	8.7	6.6	3.2	20.0	4000

Both Units 7 & 8 are treated Date	FI-216 Waste Wtr To WWTR (gpm)	FI-236 Thickener UF to WWTR (gpm)	LI-239 ABS Sump Level (%)	LI-200 ABS Hold Sump Lvl (%)	LI-203 ABS Hold Tk Level (%)
11-Aug-92	109.3	100.0	10.0	43.9	-0.1
12-Aug-92	106.9	100.0	10.0	50.5	-0.2
13-Aug-92	114.3	100.0	10.0	27.4	-0.2
17-Aug-92	110.0	100.0	10.0	57.3	-0.2
18-Aug-92	110.6	100.0	10.0	27.3	-0.2
27-Aug-92	112.1	100.0	10.0	36.6	-0.2
28-Aug-92	100.0	100.0	10.0	43.3	-0.2
1-Sep-92	109.4	100.0	10.0	25.7	2.7
2-Sep-92	110.0	100.0	10.0	32.9	2.7
3-Sep-92	103.4	100.0	10.0	23.7	2.7
4-Sep-92	105.0	88.2	10.0	29.6	2.7
21-Sep-92	112.7	100.0	10.0	51.8	2.7
22-Sep-92	113.0	100.0	10.0	55.8	2.6
22-Sep-92	111.3	100.0	10.0	56.9	2.6
23-Sep-92	106.5	100.0	10.0	46.2	2.6
24-Sep-92	102.5	100.0	10.0	13.8	2.7
25-Sep-92	101.7	100.0	10.0	17.9	2.7
29-Sep-92	105.3	100.0	10.0	43.1	2.6

Both Units 7 & 8 are treated Date	LI-206 Thickener Sump Level (%)	FI-264 Total Wtr o Facilit (gpm)	FQI-264 Totalized Water (gal)	FIC-344 F A S Oxid Air (scfm)	FIC-345 A R S Oxid Air (scfm)
11-Aug-92	25.1	1054.2	18572	8001	6996
12-Aug-92	25.8	1101.5	20078	7998	7004
13-Aug-92	26.3	1597.9	22119	8002	6999
17-Aug-92	29.7	1656.6	30683	8010	6994
18-Aug-92	33.6	1517.5	32749	7991	6998
27-Aug-92	32.4	1597.1	49896	6995	7007
28-Aug-92	39.8	1751.6	51882	7983	6998
1-Sep-92	34.1	1860.4	62230	6999	7004
2-Sep-92	31.8	1832.2	64971	7000	6996
3-Sep-92	34.1	1828.7	67355	8007	6997
4-Sep-92	37.8	1827.2	70057	7005	6995
21-Sep-92	51.3	1880.3	0	6995	8004
22-Sep-92	56.3	1863.2	0	7999	8265
22-Sep-92	57.7	1372.1	0	8000	8505
23-Sep-92	62.9	1197.1	0	7996	8498
24-Sep-92	21.3	1583.1	0	7999	7000
25-Sep-92	27.8	1552.1	0	0	7011
29-Sep-92	42.1	1605.8	0	0	6994

Both Units 7 & 8 are treated Date	WI-455 Gypsum Rate (tons)	WQI-455 Totalized Gypsum (ktons)	PI-023 Lmstn Xfer A Pressur (psig)	PI-028 Lmstn Xfer B Pressur (psig)	PDI-114 Absorber D-P (iwc)
11-Aug-92	21.2	12.9	0.6	17.2	5.6
12-Aug-92	31.1	13.7	5.8	11.9	4.8
13-Aug-92	32.4	14.5	18.1	0.4	5.1
17-Aug-92	60.9	17.3	18.4	0.4	5.3
18-Aug-92	25.6	18.0	0.5	17.2	5.3
27-Aug-92	43.5	21.2	16.5	2.6	5.4
28-Aug-92	33.6	22.0	14.8	14.9	5.3
1-Sep-92	30.6	24.8	0.4	17.5	3.9
2-Sep-92	30.8	25.6	19.9	0.8	3.8
3-Sep-92	45.6	26.2	13.8	6.7	6.0
4-Sep-92	49.2	27.2	0.5	17.7	4.7
21-Sep-92	49.9	38.3	0.2	17.3	4.8
22-Sep-92	39.9	38.9	0.2	18.2	6.2
22-Sep-92	44.4	39.1	0.2	16.8	4.0
23-Sep-92	25.2	39.8	17.3	0.0	3.3
24-Sep-92	36.6	40.5	18.0	0.0	4.6
25-Sep-92	29.1	41.3	8.7	10.1	5.3
29-Sep-92	31.0	42.9	5.3	15.3	5.0

Both Units 7 & 8 are treated Date	PDI-115-01 F G D D-P (iwc)	PDI-116 M/E D-P (iwc)	PI-147A Rec Header A Pressur (psig)	PI-147B Rec Header B Pressur (psig)	PI-214 WES Nozzle Pressur (psig)
11-Aug-92	7.8	2.1	17.0	18.9	-2.5
12-Aug-92	6.9	2.0	17.0	18.8	-1.8
13-Aug-92	7.3	2.2	17.1	18.9	-2.3
17-Aug-92	6.9	1.6	17.6	19.4	-2.4
18-Aug-92	7.0	1.6	17.6	19.5	-2.3
27-Aug-92	7.6	2.2	17.5	19.4	-1.9
28-Aug-92	7.3	2.1	17.4	19.3	-1.7
1-Sep-92	6.4	2.5	16.2	18.2	-2.2
2-Sep-92	7.2	3.4	16.2	19.3	-2.0
3-Sep-92	8.3	2.2	19.0	19.6	-2.3
4-Sep-92	6.8	2.2	16.2	18.1	-2.2
21-Sep-92	6.9	2.1	17.3	19.1	-2.4
22-Sep-92	8.4	2.2	18.7	20.3	-1.1
22-Sep-92	5.5	1.5	18.6	20.2	-1.3
23-Sep-92	4.8	1.4	17.5	19.0	-0.8
24-Sep-92	6.5	1.9	17.6	19.2	-1.2
25-Sep-92	7.3	2.1	17.5	19.1	65.7
29-Sep-92	7.0	2.0	17.4	19.0	63.2

Both Units 7 & 8 are treated Date	PI-300 Oxid Air Pressur (psig)	UI-152 No of Rec ump Runnin (#)	IL-153A P-120-A Amps (amps)	IL-153B P-120-B Amps (amps)	IL-153C P-120-C Amps (amps)
11-Aug-92	11.0	9	55.2	0.2	55.3
12-Aug-92	11.0	9	55.6	0.2	55.7
13-Aug-92	11.0	9	55.7	54.5	56.0
17-Aug-92	11.0	9	56.5	55.2	56.9
18-Aug-92	11.0	9	56.7	55.3	56.8
27-Aug-92	10.0	9	57.4	0.2	57.1
28-Aug-92	10.0	9	57.6	0.2	57.6
1-Sep-92	10.0	7	59.1	0.2	59.0
2-Sep-92	10.0	8	58.7	0.2	58.5
3-Sep-92	10.0	10	56.8	54.5	55.9
4-Sep-92	10.0	7	58.7	0.2	58.7
21-Sep-92	9.7	9	56.3	-25.1	56.5
22-Sep-92	10.0	11	55.2	54.0	55.2
22-Sep-92	10.0	11	55.1	53.9	55.1
23-Sep-92	10.0	9	57.2	56.1	0.2
24-Sep-92	10.0	9	57.4	56.2	0.2
25-Sep-92	11.0	9	57.1	55.9	0.2
29-Sep-92	10.5	9	57.6	56.0	0.2

Both Units 7 & 8 *are treated* Date	IL-153D P-120-D Amps (amps)	IL-15E P-120-E Amps (amps)	IL-153F P-120-F Amps (amps)	IL-153G P-120-G Amps (amps)	IL-153H P-120-H Amps (amps)
11-Aug-92	56.2	54.7	54.0	54.0	53.2
12-Aug-92	56.6	54.9	54.2	54.4	53.4
13-Aug-92	56.9	54.6	55.2	54.7	53.5
17-Aug-92	57.9	0.2	57.4	55.4	54.9
18-Aug-92	57.6	0.2	57.2	55.6	54.6
27-Aug-92	58.0	56.6	55.8	57.3	0.2
28-Aug-92	58.0	56.3	55.6	57.3	0.2
1-Sep-92	59.3	0.2	58.6	58.6	0.2
2-Sep-92	59.4	-0.8	58.4	55.7	53.3
3-Sep-92	57.1	54.9	54.8	54.7	55.2
4-Sep-92	59.4	0.2	58.6	58.7	0.2
21-Sep-92	57.4	56.2	55.1	55.2	55.1
22-Sep-92	56.1	54.7	54.1	53.1	53.2
22-Sep-92	56.1	54.5	54.0	52.9	53.2
23-Sep-92	58.1	57.4	56.1	55.5	56.1
24-Sep-92	58.4	57.7	56.3	55.3	56.7
25-Sep-92	58.2	57.5	56.6	55.0	55.9
29-Sep-92	58.4	57.5	57.1	56.1	0.2

Both Units 7 & 8 are treated Date	IL-153I P-120-I Amps (amps)	IL-153J P-120-J Amps (amps)	IL-153K P-120-K Amps (amps)	IL-153L P-120-L Amps (amps)	IL-340A A Ox Air Blower amps
11-Aug-92	56.4	0.2	0.2	55.5	64.7
12-Aug-92	56.6	0.2	0.2	56.0	65.1
13-Aug-92	56.8	0.2	0.2	56.3	65.4
17-Aug-92	57.8	0.2	0.2	57.2	64.9
18-Aug-92	57.9	0.2	0.2	57.2	64.8
27-Aug-92	58.1	0.2	55.6	57.0	60.7
28-Aug-92	57.8	0.2	55.2	57.0	63.4
1-Sep-92	59.7	0.2	0.2	58.9	60.1
2-Sep-92	-4.9	2.8	56.6	57.0	60.1
3-Sep-92	2.7	-0.4	55.9	56.5	62.3
4-Sep-92	0.1	0.2	57.5	58.3	62.2
21-Sep-92	0.1	0.2	55.7	56.0	0.3
22-Sep-92	56.0	0.2	54.3	54.1	0.3
22-Sep-92	55.8	0.2	54.3	53.9	0.3
23-Sep-92	0.1	0.2	56.5	56.7	0.3
24-Sep-92	0.1	0.2	56.7	56.7	0.3
25-Sep-92	0.1	0.2	56.8	56.1	0.3
29-Sep-92	57.5	0.2	56.1	56.0	0.3

Both Units 7 & 8 are treated Date	IL-340B B Ox Air Blower amps	IL-340C C Ox Air Blower amps	IL-340D D Ox Air Blower amps	NI VAR HOUR KVA	NI WATT HOUR KWH
11-Aug-92	0.3	0.3	64.1	1378	1199
12-Aug-92	0.3	0.3	64.5	1470	1280
13-Aug-92	0.3	0.3	64.8	1553	1352
17-Aug-92	0.3	0.3	64.2	1880	1641
18-Aug-92	0.3	0.3	64.2	1961	1713
27-Aug-92	0.3	0.3	60.1	2560	2322
28-Aug-92	0.3	0.3	62.0	2631	2385
1-Sep-92	0.3	0.3	59.7	2958	2679
2-Sep-92	0.3	0.3	59.5	3039	2752
3-Sep-92	0.3	0.3	61.3	3116	2818
4-Sep-92	0.3	0.3	57.9	3198	2886
21-Sep-92	60.8	0.3	60.6	4454	3939
22-Sep-92	66.1	0.3	65.7	4525	3994
22-Sep-92	67.4	0.3	66.9	4548	4012
23-Sep-92	67.0	0.3	66.4	4626	4072
24-Sep-92	62.5	0.3	62.4	4700	4131
25-Sep-92	64.2	0.3	0.2	4786	4200
29-Sep-92	0.3	0.3	63.9	5052	4419

Both Units 7 & 8 are treated Date	NI WATT HOUR KWH	UNIT #7 ON STREAM HOUR	UNIT #8 ON STREAM HOUR	IL-355A A ARS apms	IL-355B B ARS amps
11-Aug-92	1126	414	414	40.2	48.2
12-Aug-92	1206	442	441	49.0	49.2
13-Aug-92	1275	465	465	49.4	49.3
17-Aug-92	1546	559	559	50.0	50.2
18-Aug-92	1614	582	582	50.3	50.4
27-Aug-92	2084	796	624	50.3	50.7
28-Aug-92	2142	816	644	50.4	50.6
1-Sep-92	2415	915	731	50.2	50.2
2-Sep-92	2482	940	756	50.0	50.1
3-Sep-92	2546	962	778	50.6	51.0
4-Sep-92	2615	986	802	50.0	50.0
21-Sep-92	3749	1123	1210	48.7	50.5
22-Sep-92	3819	1143	1230	48.9	50.4
22-Sep-92	3842	1150	1236	48.5	50.2
23-Sep-92	3920	1173	1259	48.8	49.6
24-Sep-92	3994	1195	1281	50.2	50.6
25-Sep-92	4077	1221	1307	45.9	49.7
29-Sep-92	4336	1314	1343	45.9	49.7

Both Units 7 & 8 are treated Date	IL-355C C ARS amps	TISH-210 #8 Duct DWNSTRM WES (F)	TISH-213 #8 Duct DWNSTRM WES (F)	NI-SO2-EFF SO2 REMOVAL (%)	IL-101-4
11-Aug-92	48.0	298	374	0.28	1295
12-Aug-92	49.1	295	371	0.32	1236
13-Aug-92	49.7	293	372	0.28	1323
17-Aug-92	50.0	293	372	0.23	1313
18-Aug-92	50.4	293	372	0.57	1327
27-Aug-92	50.1	306	339	0.42	1347
28-Aug-92	50.2	306	340	0.37	1352
1-Sep-92	49.9	305	340	0.38	1292
2-Sep-92	49.5	305	341	0.57	1320
3-Sep-92	50.5	306	342	0.39	1354
4-Sep-92	49.5	305	343	0.65	1348
21-Sep-92	47.9	317	360	0.49	1221
22-Sep-92	48.7	319	363	0.39	1331
22-Sep-92	48.2	319	361	0.23	987
23-Sep-92	48.5	319	360	0.24	943
24-Sep-92	49.9	317	363	0.36	1194
25-Sep-92	46.4	317	364	0.53	1332
29-Sep-92	46.8	317	365	0.51	1264

Both Units 7 & 8 are treated Date	FIC-191 THICK FEED GPM	TR-124-01 FGD OUTLET TEMP (F)	AI-1001 NEWT/DESAT TANK PH	AI-1002 WWTR OUTLET PH
11-Aug-92	788.6	131	0.00	0.48
12-Aug-92	767.3	131	0.28	0.18
13-Aug-92	1000.6	131	0.32	0.00
17-Aug-92	1226.1	131	0.34	0.53
18-Aug-92	532.9	132	0.00	0.47
27-Aug-92	948.6	131	0.34	0.00
28-Aug-92	817.4	130	0.53	0.00
1-Sep-92	619.5	130	7.49	7.79
2-Sep-92	726.0	131	7.47	7.72
3-Sep-92	909.1	131	7.58	7.76
4-Sep-92	937.8	131	7.51	7.71
21-Sep-92	802.0	131	7.40	7.63
22-Sep-92	882.7	130	7.54	7.23
22-Sep-92	823.6	128	7.56	7.24
23-Sep-92	502.0	129	7.76	7.57
24-Sep-92	712.4	129	7.68	7.51
25-Sep-92	637.9	131	7.48	7.34
29-Sep-92	694.7	129	6.82	6.65

Unit # 8
is treated

Date	Unit #7 Air Flow (pph)	Unit #8 Air Flow (pph)	Unit #7 Load (MW)	Unit #8 Load (MW)	AI-110A Unit #7 Opacity (%)
8-Sep-92	1019	2972	172	345	24
9-Sep-92	997	3031	162	346	23
9-Sep-92	1019	3034	166	346	23
10-Sep-92	1012	2987	168	347	23
11-Sep-92	1023	2958	169	343	25
14-Sep-92	1077	2988	175	342	33
14-Sep-92	1057	3074	174	347	31
15-Sep-92	1068	2970	174	345	38
16-Sep-92	1021	3029	168	348	24
17-Sep-92	1033	3033	169	347	23
18-Sep-92	1031	3044	170	347	19
18-Sep-92	1046	3043	173	348	18
18-Sep-92	1028	3008	169	349	19

Uint # 7
is treated

Date	Unit #7 Air Flow (pph)	Unit #8 Air Flow (pph)	Unit #7 Load (MW)	Unit #8 Load (MW)	AI-110A Unit #7 Opacity (%)
22-Aug. 92	1029	7	171	1	16
23-Aug. 92	1051	8	173	1	16
24-Aug. 92	1046	8	174	1	15
25-Aug. 92	1059	47	174	1	15
26-Aug. 92	1075	1013	176	3	15

Unit # 8 is treated Date	AI-110B Unit #8 Opacity (%)	PT-105A Unit #7 Inlet Press (iwc)	PT-105B Unit #8 Inlet Press (iwc)	PT-117 M/E Inlet Pressure (iwc)	PT118 M/E Outlet Pressure (iwc)
8-Sep-92	15	1.5	2.6	0.8	-0.3
9-Sep-92	21	1.5	2.8	1.3	-0.2
9-Sep-92	25	1.6	2.9	1.3	-0.2
10-Sep-92	18	1.5	2.8	1.5	-0.3
11-Sep-92	16	1.9	3.0	1.1	-0.1
14-Sep-92	9	1.7	3.2	1.3	-0.1
14-Sep-92	8	1.6	3.3	1.3	-0.1
15-Sep-92	32	1.6	3.2	1.0	-0.1
16-Sep-92	20	1.5	3.6	0.9	-0.1
17-Sep-92	20	1.6	3.0	0.9	-0.1
18-Sep-92	25	1.6	2.8	0.8	-0.2
18-Sep-92	32	1.6	2.9	0.8	-0.2
18-Sep-92	18	1.5	2.8	0.8	-0.2

Uint # 7 is treated Date	AI-110B Unit #8 Opacity (%)	PT-105A Unit #7 Inlet Press (iwc)	PT-105B Unit #8 Inlet Press (iwc)	PT-117 M/E Inlet Pressure (iwc)	PT118 M/E Outlet Pressure (iwc)
22-Aug. 92	5	0.2	0.2	-0.2	-0.3
23-Aug. 92	5	0.3	0.2	-0.2	-0.3
24-Aug. 92	5	0.3	0.2	-0.2	-0.3
25-Aug. 92	6	0.3	0.2	-0.2	-0.3
26-Aug. 92	9	0.7	0.4	-0.3	-0.7

Unit # 8 is treated Date	TI-209 WES Inlet Temp (F)	TR-111 Absorber Inlet Temp (F)	AIT-109 Absorber Inlet SO2 (ppm)	FR-112 Absorber Inlet F.G. (kscfm)	SIC-425A Limestone Feed Rate (tph)
8-Sep-92	392	322	2238	998	0.0
9-Sep-92	392	320	2256	1092	0.0
9-Sep-92	392	320	2252	1094	0.0
10-Sep-92	395	321	2268	1119	0.0
11-Sep-92	395	324	2275	1128	8.7
14-Sep-92	400	331	2333	1076	0.0
14-Sep-92	399	330	2339	1137	0.0
15-Sep-92	401	332	2374	1017	11.2
16-Sep-92	401	331	2293	1063	6.3
17-Sep-92	400	332	2252	1048	5.6
18-Sep-92	399	328	2261	1001	2.8
18-Sep-92	400	330	2281	1004	0.0
18-Sep-92	400	328	2319	1026	0.0

Uint # 7 is treated Date	TI-209 WES Inlet Temp (F)	TR-111 Absorber Inlet Temp (F)	AIT-109 Absorber Inlet SO2 (ppm)	FR-112 Absorber Inlet F.G. (kscfm)	SIC-425A Limestone Feed Rate (tph)
22-Aug. 92	72	308	2027	490	4.8
23-Aug. 92	75	307	2002	504	1.9
24-Aug. 92	70	306	2161	530	0.0
25-Aug. 92	73	304	2166	542	0.0
26-Aug. 92	207	300	2054	555	0.0

Unit # 8 is treated Date	SIC-425B Limestone Feed Rate (tph)	SIC-3399 Lime Feed Rate (tph)	AR-126 Absorber Outlet SO2 (ppm)	FIC-127 Absorber Makeup H2O (gpm)	LI-129-01 Absorber Level (ft)
8-Sep-92	10.1	0.0	60.3	87.2	20.4
9-Sep-92	8.7	0.0	199.6	263.0	20.5
9-Sep-92	8.5	0.0	148.6	349.1	20.7
10-Sep-92	10.8	0.0	105.7	310.2	20.9
11-Sep-92	0.3	0.0	92.2	324.9	20.1
14-Sep-92	9.8	0.0	123.0	384.7	20.4
14-Sep-92	9.4	0.0	143.8	384.7	20.2
15-Sep-92	0.3	0.0	105.4	209.7	20.1
16-Sep-92	0.3	0.0	92.1	182.3	20.6
17-Sep-92	2.9	0.0	160.9	264.9	20.4
18-Sep-92	5.4	0.0	318.4	249.6	20.9
18-Sep-92	7.8	0.0	298.2	244.6	21.2
18-Sep-92	8.2	0.0	145.6	208.8	21.0

Uint # 7 is treated Date	SIC-425B Limestone Feed Rate (tph)	SIC-3399 Lime Feed Rate (tph)	AR-126 Absorber Outlet SO2 (ppm)	FIC-127 Absorber Makeup H2O (gpm)	LI-129-01 Absorber Level (ft)
22-Aug. 92	0.3	0.0	4.8	59.8	21.0
23-Aug. 92	3.6	0.0	11.3	65.5	21.2
24-Aug. 92	5.7	0.0	22.1	47.9	21.0
25-Aug. 92	6.5	0.0	18.5	54.2	20.8
26-Aug. 92	6.4	0.0	11.9	18.5	20.8

Unit # 8 is treated Date	LI-129-02 Absorber Level (ft)	LI-146 Centrifuge Fd Tk (%)	AIC-134 Absorber Density (gm/ml)	AIC-138A Absorber pH (-)	AIC-138B Absorber pH (-)
8-Sep-92	20.4	61.2	1.17	6.23	6.18
9-Sep-92	20.5	61.9	1.19	5.98	5.94
9-Sep-92	20.7	63.1	1.19	6.07	6.03
10-Sep-92	20.9	61.7	1.18	6.19	6.15
11-Sep-92	20.1	61.2	1.18	6.27	6.23
14-Sep-92	20.3	62.1	1.18	6.09	6.07
14-Sep-92	20.2	63.3	1.19	6.05	6.03
15-Sep-92	20.1	61.3	1.18	6.14	6.13
16-Sep-92	20.6	61.3	1.17	6.17	6.17
17-Sep-92	20.4	62.3	1.18	6.12	6.13
18-Sep-92	20.9	61.2	1.19	5.66	5.66
18-Sep-92	21.2	62.5	1.18	5.68	5.68
18-Sep-92	21.0	60.8	1.20	5.82	5.81

Uint # 7 is treated Date	LI-129-02 Absorber Level (ft)	LI-146 Centrifuge Fd Tk (%)	AIC-134 Absorber Density (gm/ml)	AIC-138A Absorber pH (-)	AIC-138B Absorber pH (-)
22-Aug. 92	21.0	63.2	1.18	6.16	6.35
23-Aug. 92	21.1	63.3	1.18	6.06	6.35
24-Aug. 92	21.0	62.5	1.18	6.10	6.35
25-Aug. 92	20.8	63.3	1.18	6.05	6.35
26-Aug. 92	20.8	68.6	1.18	6.01	6.68

Unit # 8 is treated Date	AIC-136 Absorber SO3 (mmol/l)	AIT-135 Absorber CO3 (mmol/l)	PI-147A "A" Header Pressur (psig)	PI-147B "B" Header Pressur (psig)	LI-194 Filtrate Sump lvl (%)
8-Sep-92	0.74	79.3	16.0	17.8	53
9-Sep-92	0.71	26.0	16.2	18.1	59
9-Sep-92	0.74	31.4	16.2	18.1	49
10-Sep-92	0.94	48.9	16.2	18.0	51
11-Sep-92	0.96	79.4	16.1	18.0	45
14-Sep-92	0.76	28.8	16.2	19.4	48
14-Sep-92	0.68	27.2	16.3	19.4	41
15-Sep-92	0.73	31.5	17.5	19.3	53
16-Sep-92	0.74	29.7	18.5	19.0	47
17-Sep-92	0.66	27.5	15.9	19.0	45
18-Sep-92	2.67	29.3	15.7	18.9	52
18-Sep-92	2.78	30.9	15.8	18.9	48
18-Sep-92	1.55	28.1	15.8	18.9	52

Uint # 7 is treated Date	AIC-136 Absorber SO3 (mmol/l)	AIT-135 Absorber CO3 (mmol/l)	PI-147A "A" Header Pressur (psig)	PI-147B "B" Header Pressur (psig)	LI-194 Filtrate Sump lvl (%)
22-Aug. 92	0.59	48.1	16.1	18.0	51.7
23-Aug. 92	0.62	28.0	16.1	18.0	54.0
24-Aug. 92	0.50	27.5	14.8	18.1	51.8
25-Aug. 92	0.45	26.6	14.6	18.0	49.9
26-Aug. 92	0.45	29.0	14.6	17.9	44.8

Unit # 8 is treated Date	AIT-190A Filtrate Sump pH (-)	AIT-190B Filtrate Sump pH (-)	FI-212 WES Water Flow Rate (gpm)	LI-220 Thickener O/F Tk Lvl (%)	AIT-221 Waste Wtr Chloride (ppm)
8-Sep-92	7.3	8.5	0.3	20.0	4490
9-Sep-92	7.4	9.0	0.3	20.0	4492
9-Sep-92	7.4	9.1	0.4	20.0	4490
10-Sep-92	7.6	8.1	0.3	20.0	4495
11-Sep-92	8.1	8.1	0.3	20.0	4493
14-Sep-92	7.4	6.8	0.5	20.0	4492
14-Sep-92	7.7	6.9	0.5	20.0	4496
15-Sep-92	7.8	6.8	0.5	20.0	4494
16-Sep-92	7.7	6.8	0.5	20.0	5494
17-Sep-92	7.6	6.8	0.5	20.0	5611
18-Sep-92	7.3	6.7	0.4	20.0	5478
18-Sep-92	7.7	6.7	0.4	20.0	5532
18-Sep-92	7.7	6.7	0.3	20.0	4545

Uint # 7 is treated Date	AIT-190A Filtrate Sump pH (-)	AIT-190B Filtrate Sump pH (-)	FI-212 WES Water Flow Rate (gpm)	LI-220 Thickener O/F Tk Lvl (%)	AIT-221 Waste Wtr Chloride (ppm)
22-Aug. 92	7.5	7.2	0.5	20.0	5538
23-Aug. 92	7.9	7.3	0.5	20.0	5534
24-Aug. 92	7.8	7.2	0.5	20.0	5533
25-Aug. 92	7.1	7.2	0.5	20.0	5532
26-Aug. 92	7.1	7.2	0.4	20.0	5535

Unit # 8 is treated Date	FI-216 Waste Wtr To WWTR (gpm)	FI-236 Thickener UF to WWTR (gpm)	LI-239 ABS Sump Level (%)	LI-200 ABS Hold Sump Lvl (%)	LI-203 ABS Hold Tk Level (%)
8-Sep-92	114.9	100.0	10.0	54.2	2.7
9-Sep-92	99.9	100.0	10.0	43.9	2.7
9-Sep-92	100.0	100.0	10.0	42.3	2.7
10-Sep-92	100.7	100.0	10.0	23.5	2.7
11-Sep-92	105.2	100.0	10.0	29.1	2.7
14-Sep-92	91.7	100.0	10.0	31.0	2.7
14-Sep-92	119.8	100.0	10.0	0.1	2.7
15-Sep-92	114.6	100.0	10.0	11.8	2.7
16-Sep-92	101.1	100.0	10.0	19.3	2.7
17-Sep-92	102.0	99.6	10.0	25.3	2.7
18-Sep-92	100.0	100.0	10.0	32.4	2.7
18-Sep-92	100.1	100.0	10.0	33.4	2.7
18-Sep-92	99.9	100.0	10.0	34.6	2.7

Uint # 7 is treated Date	FI-216 Waste Wtr To WWTR (gpm)	FI-236 Thickener UF to WWTR (gpm)	LI-239 ABS Sump Level (%)	LI-200 ABS Hold Sump Lvl (%)	LI-203 ABS Hold Tk Level (%)
22-Aug. 92	109.0	105.0	10.0	28.3	-0.1
23-Aug. 92	108.0	105.0	10.0	36.5	-0.1
24-Aug. 92	102.7	105.0	10.0	44.4	-0.1
25-Aug. 92	107.3	105.0	10.0	53.2	-0.1
26-Aug. 92	103.3	71.9	10.0	26.0	-0.2

Unit # 8 is treated Date	LI-206 Thickener Sump Level (%)	FI-264 Total Wtr to Facility (gpm)	FQI-264 Totalized Water (gal)	FIC-344 F A S Oxid Air (scfm)	FIC-345 A R S Oxid Air (scfm)
8-Sep-92	44.6	1658	79974	4993	5006
9-Sep-92	50.1	1611	82985	4994	5005
9-Sep-92	50.2	1687	83036	5000	4998
10-Sep-92	50.2	1648	85409	5001	5000
11-Sep-92	21.2	1666	87651	5000	5000
14-Sep-92	31.8	1692	94662	5004	5000
14-Sep-92	34.1	1668	95499	4996	5002
15-Sep-92	36.4	1710	97460	5002	5000
16-Sep-92	33.1	1705	25335	5023	5021
17-Sep-92	25.3	1724	0	0	4885
18-Sep-92	31.5	1736	0	0	2051
18-Sep-92	32.6	1700	0	0	2540
18-Sep-92	34.0	1738	0	0	3102

Uint # 7 is treated Date	LI-206 Thickener Sump Level (%)	FI-264 Total Wtr to Facility (gpm)	FQI-264 Totalized Water (gal)	FIC-344 F A S Oxid Air (scfm)	FIC-345 A R S Oxid Air (scfm)
22-Aug. 92	23.6	1295	40371	5612	5612
23-Aug. 92	24.5	1289	42226	5615	5611
24-Aug. 92	25.3	1304	44210	5609	5611
25-Aug. 92	25.8	1208	46017	293	5657
26-Aug. 92	26.3	1204	47837	0	2603

Unit # 8 is treated Date	WI-455 Gypsum Rate (tons)	WQI-455 Totalized Gypsum (ktons)	PI-023 Lmstn Xfer A Pressur (psig)	PI-028 Lmstn Xfer B Pressur (psig)	PDI-114 Absorber D-P (iwc)
8-Sep-92	29.0	30.1	0.4	16.2	0.7
9-Sep-92	30.2	30.7	0.6	15.6	0.2
9-Sep-92	19.8	30.7	0.6	16.1	0.3
10-Sep-92	21.6	31.3	0.6	16.3	0.0
11-Sep-92	32.9	31.9	16.3	0.2	0.8
14-Sep-92	22.7	33.5	0.0	16.0	0.5
14-Sep-92	14.3	33.7	0.1	15.8	0.3
15-Sep-92	33.8	34.2	16.2	0.3	0.7
16-Sep-92	29.5	35.0	16.5	0.3	2.7
17-Sep-92	23.2	35.5	10.9	5.3	2.0
18-Sep-92	27.5	35.9	5.7	10.4	2.0
18-Sep-92	23.5	36.0	-0.1	15.8	2.0
18-Sep-92	35.4	36.1	-0.1	16.9	2.0

Uint # 7 is treated Date	WI-455 Gypsum Rate (tons)	WQI-455 Totalized Gypsum (ktons)	PI-023 Lmstn Xfer A Pressur (psig)	PI-028 Lmstn Xfer B Pressur (psig)	PDI-114 Absorber D-P (iwc)
22-Aug. 92	12.1	19.5	13.9	0.2	0.4
23-Aug. 92	7.0	19.7	6.0	7.9	0.4
24-Aug. 92	11.7	20.0	1.2	14.0	0.4
25-Aug. 92	8.0	20.4	1.2	14.1	0.5
26-Aug. 92	12.4	20.7	1.1	13.8	1.0

Unit # 8 is treated Date	PDI-115-01 F G D D-P (iwc)	PDI-116 M/E D-P (iwc)	PI-147A Rec Header A Pressur (psig)	PI-147B Rec Header B Pressur (psig)	PI-214 WES Nozzle Pressur (psig)
8-Sep-92	1.7	1.1	16.0	17.8	-1.8
9-Sep-92	1.7	1.5	16.2	18.1	-3.2
9-Sep-92	1.8	1.5	16.2	18.1	-3.4
10-Sep-92	1.8	1.7	16.2	18.0	-2.6
11-Sep-92	2.0	1.2	16.1	18.0	-3.3
14-Sep-92	1.8	1.4	16.2	19.4	-4.1
14-Sep-92	1.8	1.5	16.3	19.4	-4.2
15-Sep-92	1.7	1.0	17.5	19.3	-4.4
16-Sep-92	3.7	1.0	18.5	19.0	-4.3
17-Sep-92	3.1	1.0	15.9	19.0	-3.1
18-Sep-92	3.0	1.0	15.7	18.9	-1.9
18-Sep-92	3.1	1.0	15.8	18.9	-1.8
18-Sep-92	3.0	1.1	15.8	18.9	-0.8

Uint # 7 is treated Date	PDI-115-01 F G D D-P (iwc)	PDI-116 M/E D-P (iwc)	PI-147A Rec Header A Pressur (psig)	PI-147B Rec Header B Pressur (psig)	PI-214 WES Nozzle Pressur (psig)
22-Aug. 92	0.5	0.1	16.1	18.0	-2.5
23-Aug. 92	0.5	0.1	16.1	18.0	-2.8
24-Aug. 92	0.5	0.1	14.8	18.1	-2.8
25-Aug. 92	0.6	0.1	14.6	18.0	-3.1
26-Aug. 92	1.4	0.4	14.6	17.9	-2.5

Unit # 8 is treated Date	PI-300 Oxid Air Pressur (psig)	UI-152 No of Rec ump Runnin (#)	IL-153A P-120-A Amps (amps)	IL-153B P-120-B Amps (amps)	IL-153C P-120-C Amps (amps)
8-Sep-92	11.0	7	58.4	-0.7	58.9
9-Sep-92	11.0	7	58.9	58.0	59.6
9-Sep-92	11.0	7	59.0	58.1	59.6
10-Sep-92	11.0	7	58.8	58.0	59.5
11-Sep-92	11.0	7	58.6	57.8	59.3
14-Sep-92	11.0	8	58.9	58.0	59.7
14-Sep-92	11.0	8	59.0	58.1	60.0
15-Sep-92	11.0	9	57.2	56.1	58.0
16-Sep-92	11.0	10	54.7	53.3	55.3
17-Sep-92	9.5	8	58.4	57.4	0.2
18-Sep-92	9.8	8	58.3	-25.1	58.7
18-Sep-92	9.5	8	58.1	-25.1	58.4
18-Sep-92	10.1	8	58.6	-25.1	59.1

Uint # 7 is treated Date	PI-300 Oxid Air Pressur (psig)	UI-152 No of Rec ump Runnin (#)	IL-153A P-120-A Amps (amps)	IL-153B P-120-B Amps (amps)	IL-153C P-120-C Amps (amps)
22-Aug. 92	11.5	7	58.0	0.2	58.5
23-Aug. 92	11.6	7	58.1	0.2	58.6
24-Aug. 92	11.7	6	59.7	0.2	0.2
25-Aug. 92	10.3	6	59.5	0.2	0.2
26-Aug. 92	9.8	6	60.2	0.2	0.2

Unit # 8 is treated Date	IL-153D P-120-D Amps (amps)	IL-15E P-120-E Amps (amps)	IL-153F P-120-F Amps (amps)	IL-153G P-120-G Amps (amps)	IL-153H P-120-H Amps (amps)
8-Sep-92	59.6	-0.7	58.9	58.7	0.2
9-Sep-92	0.1	0.2	59.5	25.8	26.5
9-Sep-92	0.1	0.2	59.6	58.7	1.1
10-Sep-92	0.1	0.2	59.5	59.1	0.2
11-Sep-92	0.1	0.2	59.5	58.9	0.2
14-Sep-92	0.1	0.2	59.4	56.0	56.3
14-Sep-92	0.1	0.2	59.6	56.2	56.4
15-Sep-92	0.1	57.3	56.4	55.6	55.7
16-Sep-92	55.7	54.4	53.7	54.9	55.1
17-Sep-92	0.1	59.2	58.4	55.5	55.4
18-Sep-92	0.1	59.0	57.9	55.8	55.5
18-Sep-92	0.1	58.8	58.0	55.8	55.4
18-Sep-92	0.1	59.3	58.6	56.1	55.9

Uint # 7 is treated Date	IL-153D P-120-D Amps (amps)	IL-15E P-120-E Amps (amps)	IL-153F P-120-F Amps (amps)	IL-153G P-120-G Amps (amps)	IL-153H P-120-H Amps (amps)
22-Aug. 92	59.3	0.2	59.0	58.7	0.2
23-Aug. 92	59.3	0.2	59.1	58.6	0.2
24-Aug. 92	60.4	0.2	60.0	58.6	0.2
25-Aug. 92	60.4	0.2	59.6	58.3	0.2
26-Aug. 92	61.1	0.2	60.2	58.8	0.2

Unit # 8 is treated Date	IL-153I P-120-I Amps (amps)	IL-153J P-120-J Amps (amps)	IL-153K P-120-K Amps (amps)	IL-153L P-120-L Amps (amps)	IL-340A A Ox Air Blower amps
8-Sep-92	0.1	0.2	58.2	58.2	0.3
9-Sep-92	0.1	0.2	58.2	58.6	0.3
9-Sep-92	0.1	0.2	58.5	58.7	0.3
10-Sep-92	0.1	0.2	58.5	58.7	0.3
11-Sep-92	0.1	0.2	58.3	58.7	0.3
14-Sep-92	0.1	0.2	57.0	57.0	0.3
14-Sep-92	0.1	0.2	57.2	57.2	0.3
15-Sep-92	0.1	0.2	56.7	56.9	4.1
16-Sep-92	0.1	0.2	56.1	56.1	0.3
17-Sep-92	0.1	0.2	56.8	56.6	0.3
18-Sep-92	0.1	0.2	56.8	56.8	0.3
18-Sep-92	0.1	0.2	56.8	56.7	0.3
18-Sep-92	0.1	0.2	57.4	57.1	0.3

Uint # 7 is treated Date	IL-153I P-120-I Amps (amps)	IL-153J P-120-J Amps (amps)	IL-153K P-120-K Amps (amps)	IL-153L P-120-L Amps (amps)	IL-340A A Ox Air Blower amps
22-Aug. 92	59.8	0.2	0.2	58.6	93.6
23-Aug. 92	59.9	0.2	0.2	58.7	93.4
24-Aug. 92	59.9	0.2	0.2	58.6	93.7
25-Aug. 92	59.6	0.2	0.2	58.3	46.4
26-Aug. 92	60.2	0.2	0.2	58.7	0.3

Unit # 8 is treated Date	IL-340B B Ox Air Blower amps	IL-340C C Ox Air Blower amps	IL-340D D Ox Air Blower amps	NI VAR HOUR KVA	NI WATT HOUR KWH
8-Sep-92	0.3	0.3	80.6	3493	3147
9-Sep-92	0.3	0.3	80.5	3577	3216
9-Sep-92	0.3	0.3	80.3	3579	3217
10-Sep-92	0.3	0.3	80.3	3647	3271
11-Sep-92	0.3	0.3	80.1	3714	3326
14-Sep-92	0.3	0.3	80.0	3908	3491
14-Sep-92	0.3	0.3	80.2	3933	3513
15-Sep-92	0.3	0.3	79.9	3994	3563
16-Sep-92	0.3	0.3	80.3	4086	3638
17-Sep-92	0.3	0.3	58.4	4156	3700
18-Sep-92	0.3	0.3	58.9	4204	3743
18-Sep-92	0.3	0.3	59.0	4217	3753
18-Sep-92	0.3	0.3	60.6	4232	3766

Unit # 7 is treated Date	IL-340B B Ox Air Blower amps	IL-340C C Ox Air Blower amps	IL-340D D Ox Air Blower amps	NI VAR HOUR KVA	NI WATT HOUR KWH
22-Aug. 92	0.3	0.3	0.2	2231	1986
23-Aug. 92	0.3	0.3	0.2	2296	2056
24-Aug. 92	0.3	0.3	0.2	2364	2132
25-Aug. 92	14.9	0.3	0.2	2425	2197
26-Aug. 92	67.2	0.3	0.2	2487	2255

Unit # 8
is treated

Date	NI WATT HOUR KWH	UNIT #7 ON STREAM HOUR	UNIT #8 ON STREAM HOUR	IL-355A A ARS apms	IL-355B B ARS amps
8-Sep-92	2857	1063	893	23.9	49.6
9-Sep-92	2940	1063	923	52.2	51.6
9-Sep-92	2941	1063	923	52.2	51.6
10-Sep-92	3006	1063	947	51.7	48.6
11-Sep-92	3070	1063	970	51.9	51.5
14-Sep-92	3244	1063	1040	52.3	52.0
14-Sep-92	3267	1063	1048	52.7	52.0
15-Sep-92	3324	1063	1067	52.0	51.7
16-Sep-92	3411	1063	1095	50.5	50.4
17-Sep-92	3475	1063	1118	46.6	49.4
18-Sep-92	3515	1063	1135	43.5	44.3
18-Sep-92	3525	1063	1139	43.5	44.3
18-Sep-92	3537	1063	1144	44.9	45.4

Uint # 7
is treated

Date	NI WATT HOUR KWH	UNIT #7 ON STREAM HOUR	UNIT #8 ON STREAM HOUR	IL-355A A ARS apms	IL-355B B ARS amps
22-Aug. 92	1831	673	613	51.8	50.7
23-Aug. 92	1880	697	613	51.6	49.6
24-Aug. 92	1929	723	613	51.8	50.5
25-Aug. 92	1971	747	613	46.3	48.4
26-Aug. 92	2022	771	613	44.6	44.8

Unit # 8 is treated Date	IL-355C C ARS amps	TISH-210 #8 Duct DWNSTRM WES (F)	TISH-213 #8 Duct DWNSTRM WES (F)	NI-SO2-EFF SO2 REMOVAL (%)	IL-101-4
8-Sep-92	49.7	307	347	0.16	827
9-Sep-92	51.2	305	347	0.52	834
9-Sep-92	51.3	306	346	0.40	833
10-Sep-92	51.3	308	350	0.31	833
11-Sep-92	50.9	309	352	0.26	822
14-Sep-92	51.9	315	356	0.36	812
14-Sep-92	52.3	315	356	0.43	824
15-Sep-92	51.2	316	358	0.32	817
16-Sep-92	50.0	316	358	0.29	826
17-Sep-92	48.0	317	358	0.48	823
18-Sep-92	43.6	316	356	0.94	826
18-Sep-92	44.7	317	357	0.86	827
18-Sep-92	47.2	316	357	0.40	832

Uint # 7 is treated Date	IL-355C C ARS amps	TISH-210 #8 Duct DWNSTRM WES (F)	TISH-213 #8 Duct DWNSTRM WES (F)	NI-SO2-EFF SO2 REMOVAL (%)	IL-101-4
22-Aug. 92	50.9	69	72	0.0	508
23-Aug. 92	50.5	72	74	0.0	512
24-Aug. 92	50.3	68	70	0.1	513
25-Aug. 92	47.6	71	73	0.1	515
26-Aug. 92	45.4	186	205	0.0	519

Unit # 8 is treated Date	FIC-191 THICK FEED GPM	TR-124-01 FGD OUTLET TEMP (F)	AI-1001 NEWT/DESAT TANK PH	AI-1002 WWTR OUTLET PH
8-Sep-92	569.0	130	7.5	7.7
9-Sep-92	438.3	132	7.7	8.0
9-Sep-92	490.5	132	7.7	7.9
10-Sep-92	535.4	130	7.5	7.7
11-Sep-92	723.7	131	7.5	7.8
14-Sep-92	570.9	132	7.6	7.8
14-Sep-92	541.2	132	7.4	7.8
15-Sep-92	601.3	133	7.3	7.5
16-Sep-92	656.1	132	7.2	7.5
17-Sep-92	519.7	132	7.5	7.7
18-Sep-92	651.4	131	7.5	7.8
18-Sep-92	596.1	131	7.5	7.7
18-Sep-92	525.1	130	7.5	7.7

Uint # 7 is treated Date	FIC-191 THICK FEED GPM	TR-124-01 FGD OUTLET TEMP (F)	AI-1001 NEWT/DESAT TANK PH	AI-1002 WWTR OUTLET PH
22-Aug. 92	287.4	130	0.0	0.0
23-Aug. 92	323.8	130	0.0	0.0
24-Aug. 92	317.0	132	0.0	0.3
25-Aug. 92	233.0	132	0.0	0.0
26-Aug. 92	413.4	132	0.3	0.1

SECTION 6.9 CONVERSION TABLE

SECTION 6.9 UNIT CONVERSION TABLE

FROM	TO	MULTIPLY	FROM	TO	MULTIPLY
ft	m	0.3048	m	ft	3.281
in	mm	25.4	mm	in	0.03937
ft^2	m^2	0.09290	m^2	ft^2	10.76
ACF	m^3	0.02832	m^3	ACF	35.31
SCF	Nm^3	0.02679	Nm^3	SCF	37.33 60°F
		0.02629			38.04 70°F
SCFM	Nm^3/h	1.607	Nm^3/h	SCFM	0.6221 60°F
		1.577			0.6341 70°F
lb	Kg	0.4536	Kg	lb	2.2046
long ton (UK)	ton	1.016	ton	long ton (UK)	0.9842
short ton (US)	ton	0.9072	ton	short ton (US)	1.1023
lb/ft^3	Kg/m^3	16.018	Kg/m^3	lb/ft^3	0.06243
lb/in^2	Kg/cm^2	0.07031	Kg/cm^2	lb/in^2	14.22
Gal (US)	l	3.785	l	Gal (US)	0.2642
GPM	m^3/h	0.2271	m^3/h	GPM	4.403
HP (US UK)	Kw	0.7460	Kw	HP (US UK)	1.3405
PS (FR)	Kw	0.7355	Kw	PS (FR)	1.3596
BTU/h	Kcal/h	0.252	Kcal/h	BTU/h	3.968
$BTU/ft^2h°F$	$Kcal/m^2h°C$	4.882	$Kcal/m^2h°C$	$BTU/ft^2h°F$	0.2048
BTU/fth°F	Kcal/mh°C	1.488	Kcal/mh°C	BTU/fth°F	0.6720
BTU/lb	Kcal/Kg	0.556	Kcal/Kg	BTU/lb	1.8
$Gal/10^3SCF$	$1/Nm^3$	0.1407	$1/Nm^3$	$Gal/10^3SCF$	7.11
grains/ACF	g/m^3	2.288	g/m^3	grains/ACF	0.437

(Note) * 7000 grains = 1 lb ** mill = 1/1000 in

*** 1 GPM = 0.5007 * (density ; Kg/m^3) lb/h

DOE1B.DOC